MECHANICAL ENGINEERING

• JANUARY 1951 •

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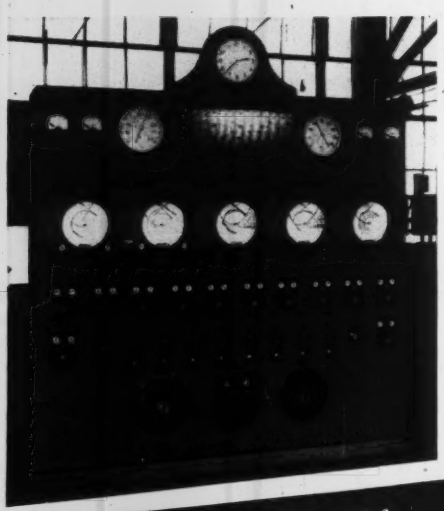

This Bailey Boiler Control Panel in a mid-western industrial plant saves fuel and insures safe operation of a 100,000 lb per hr, 175 psi, sat., pulverized coal and gas-fired boiler.

What's Your Control-Dollar Efficiency?

Control-dollars frequently bring annual investment returns of 100% or more. When you buy adequate, well-applied steam plant controls, you increase your dollars' ability to work usefully for you.

That's where Bailey can help: Bailey Controls can give you a better control-dollar efficiency. Here's why:

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service — conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

For better control-dollar efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

A-112-1

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BAILEY METER COMPANY

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CLEVELAND 10, OHIO

Controls for Steam Plants
COMBUSTION · FEED WATER
TEMPERATURE · PRESSURE
LIQUID LEVEL · FEED PUMPS

You Can't Buy
A BETTER BEARING

The know-how
of bearing making
can't be found
in books.
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at New Departure
for generations
like folk lore.

Nothing Rolls Like a Ball...

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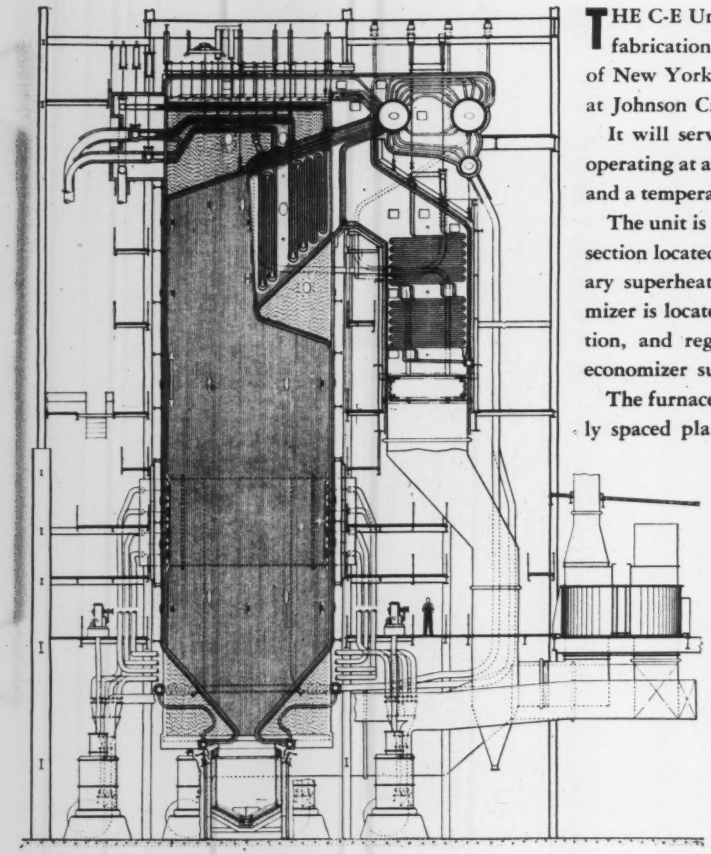
C-E REHEAT BOILERS

GOUDEY STATION

NEW YORK STATE ELECTRIC & GAS CORPORATION



THE C-E Unit illustrated here is in process of fabrication for the Goudey Station addition of New York State Electric & Gas Corporation at Johnson City, New York.

It will serve a 75,000 kw turbine generator operating at an initial steam pressure of 1450 psi and a temperature of 1000 F reheated to 1000 F.

The unit is of the radiant type with a reheater section located between the primary and secondary superheater surface. A finned tube economizer is located below the rear superheater section, and regenerative air heaters follow the economizer surface.

The furnace is fully water cooled, using closely spaced plain tubes throughout. It is of the basket-bottom type, discharging to a sluicing ash hopper.

Pulverized coal firing is employed, using bowl mills and vertically-adjustable, tangential burners.

B-431

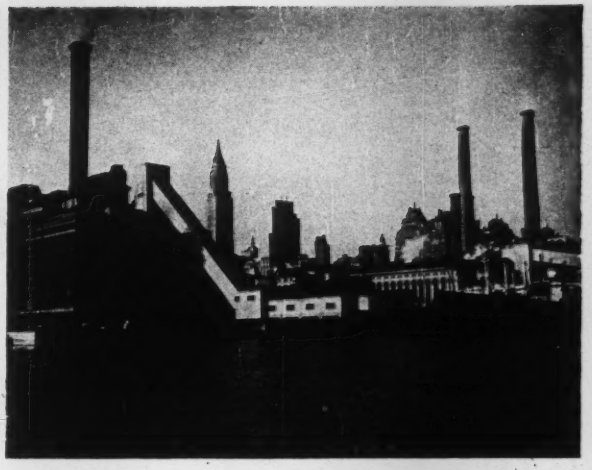
C-E

COMBUSTION ENGINEERING—
SUPERHEATER, INC.

200 Madison Avenue • New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

3 GOOD WAYS TO Stop Wasting Water



1 Make *raw* water fit for industrial use by *straining* it.

If you're in a scarce-water community, save water and cut your water bill—use a Cuno FLO-KLEAN strainer to remove trash from river or lake water. Its permanent wire-wound cartridge positively removes all solids larger than specified*, with negligible drop in pressure.

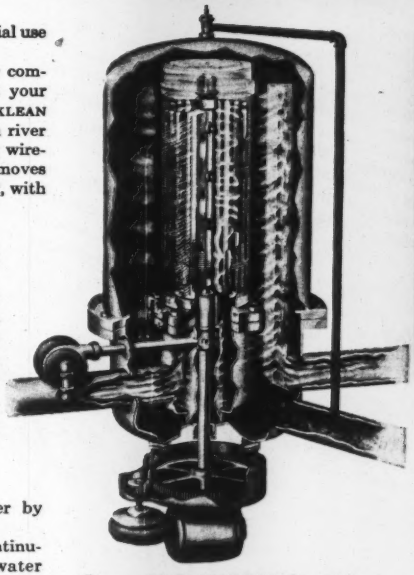
2 Reclaim and recirculate *used* water by *straining* it.

If you use water for process work, lower your water and water-heating costs—clean out contaminating solids with a Cuno FLO-KLEAN, and recirculate. Being continuously self-cleaning, it handles full flow—no expensive duplex installation needed.

3 Save valuable *backwash* water by using a FLO-KLEAN strainer.

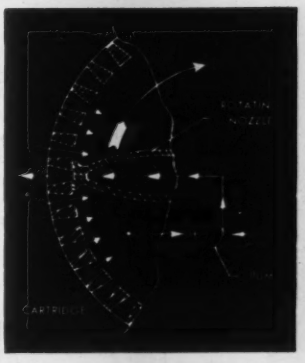
Only Cuno FLO-KLEAN is continuously self-cleaning without water waste. Used backwash is returned to the system. And—with automatic cartridge and automatic top and/or bottom blow-down—it can be installed in a remote place and virtually forgotten.

*Available spacings from .0025 to .020 in.



Cuno FLO-KLEAN Strainer

Permanent, abrasive and corrosion resistant.



Cuno's unique backwash system wastes no water.

FLO-KLEAN PAID FOR IN ONLY 6 MONTHS!

A bottling plant in a scarce-water area saved water and paid for its FLO-KLEAN in 6 months out of savings from making wash water reusable.

Find Out How to Save Money cleaning any fluids containing abrasives

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CUNO

Complete Line Fluid Conditioning

Removes More Sizes of Solids from More Types of Fluids

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Company.....
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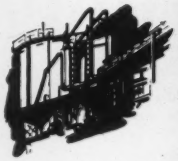

SLUDGE BLANKET HOT LIME SODA. The application of the sludge blanket design to hot lime soda treatment gives you soft water of a low silica content. **HOT ZEOLITE.** Subsequent treatment by Permutit Q® yields a final zero-hardness effluent.

PRECIPITATOR. The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity. It can also be used to reduce silica.

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Whatever your water treatment problem, Permutit offers all types of equipment and minerals that can supply soft, clear, chemically correct water for your plant. Write for full information to The Permutit Company, ME-1, 330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., Montreal.

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WATER CONDITIONING HEADQUARTERS

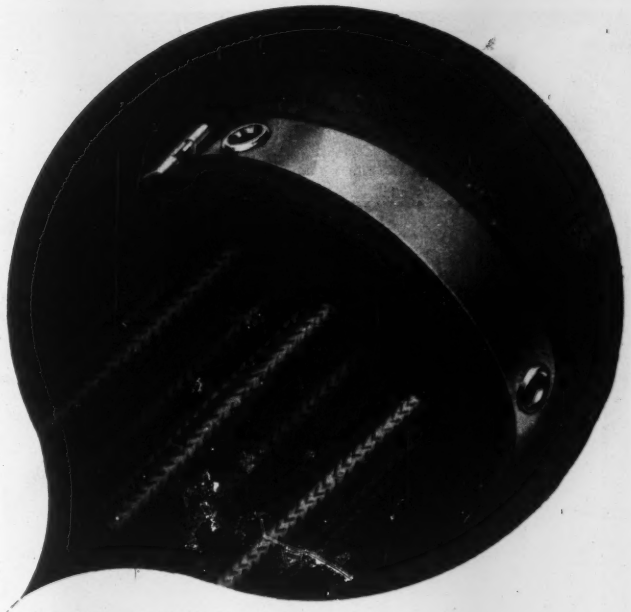
another

good product

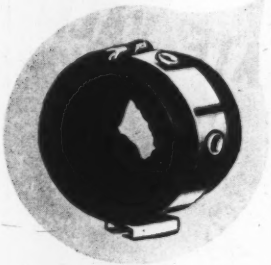
made better

by **SPONGEX®**

cellular rubber



Spongex Cellular Rubber Lining Makes Electrical Wiring Safer Easier to Install And Service



Electrical wiring failure may be a temporary annoyance . . . or a costly stoppage on a production line. It's just a matter of where and when it occurs.

To prevent wiring failures Monadnock Mills, San Leandro, California, a subsidiary of United-Carr Fastener Corporation, designed and produces a line of wire harness bands featuring a lining of Spongex cellular rubber. Spongex lining, an excellent insulator, holds each wire securely in place, yet cushions each to prevent chafing.

For easier quicker installation and servicing, the resilient Spongex lining permits the addition or removal of a limited number of wires without changing the band size.

Spongex versatility

As a material, Spongex cellular rubber possesses great versatility. It can be made as hard as wood—or as soft as a powder puff. Its cells can be porous or airtight. It readily molds, extrudes or die-cuts to shape. It can be molded to encase a metal part, even molded with an outer skin of hard rubber. It can be secured to most any surface by adhesives, or attached by mechanical means.

If you have a vibration, insulation, cushioning, gasketing, sealing or sound dampening problem, consider *Spongex*. Write us about it . . . we welcome new problems.

Technical bulletin on *Sponge Rubber* available upon request.

The World's Largest Specialists in Cellular Rubber

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SHEETS • CORDS • TUBING • STRIPS • MOLDED, EXTRUDED OR DIE-CUT SHAPES AND FORMS

THE SPONGE RUBBER PRODUCTS COMPANY

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SERIES 12100*

FORGED STEEL

DROP

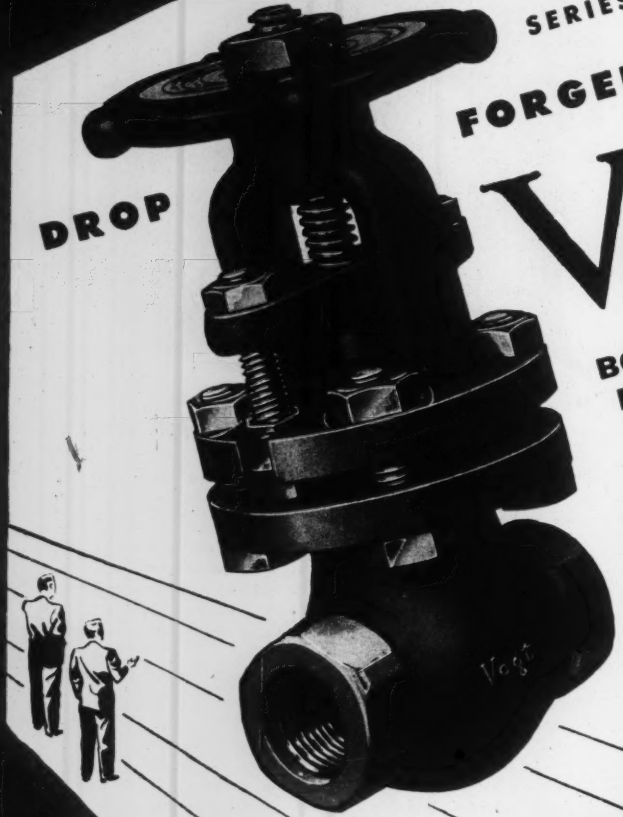
Vogt

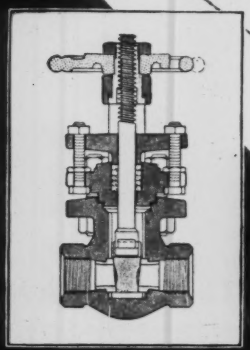
BOLTED BONNET
BOLTED GLAND

150-800 POUND

GATE VALVES

SIZES 1/4" to





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CARBON STEEL } 800 Pounds @ 750° F.
1500 Pounds Cold Non-Shock

For 150-800 pounds service • Round Bolted Bonnet • Bolted Gland • Gasket or Ground Joint • Outside Screw and Yoke • Renewable Seat Rings • Solid Wedge — Slotted Type • Rising Stem 11½-13% Chrome Stainless Steel Trimmings • Sizes ¼" to 2" inclusive.

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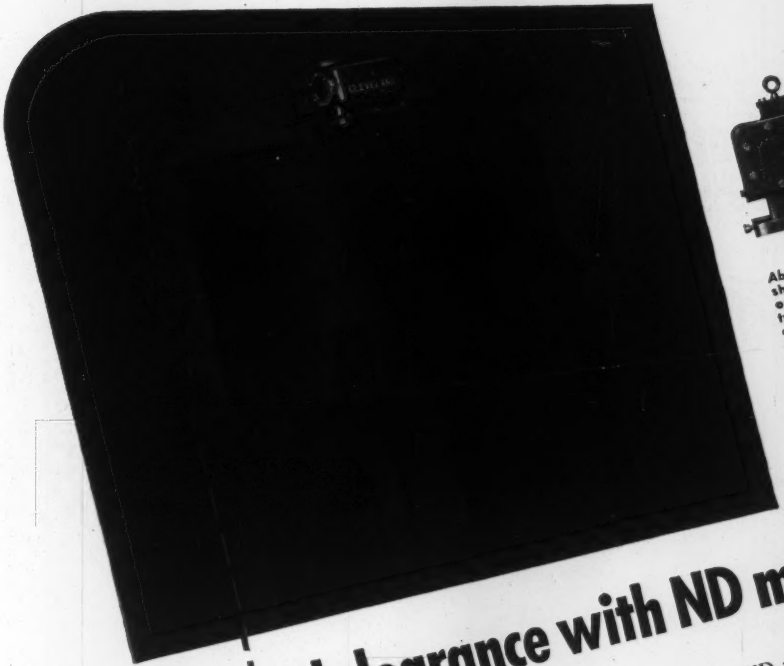
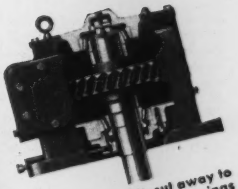
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • ST. LOUIS • DALLAS





Above—ND unit, cut away to show tapered roller bearings on gear shaft, positive face-type oil seal, unique lubricating pump and oil drain at base of housing.

Left—1,000-gallon mixing kettle built by the Water Tube Boiler & Tank Co. for the Pyroxylin Products Co., Chicago, for use in mixing viscous lacquers.

Low overhead clearance with ND mixer drive

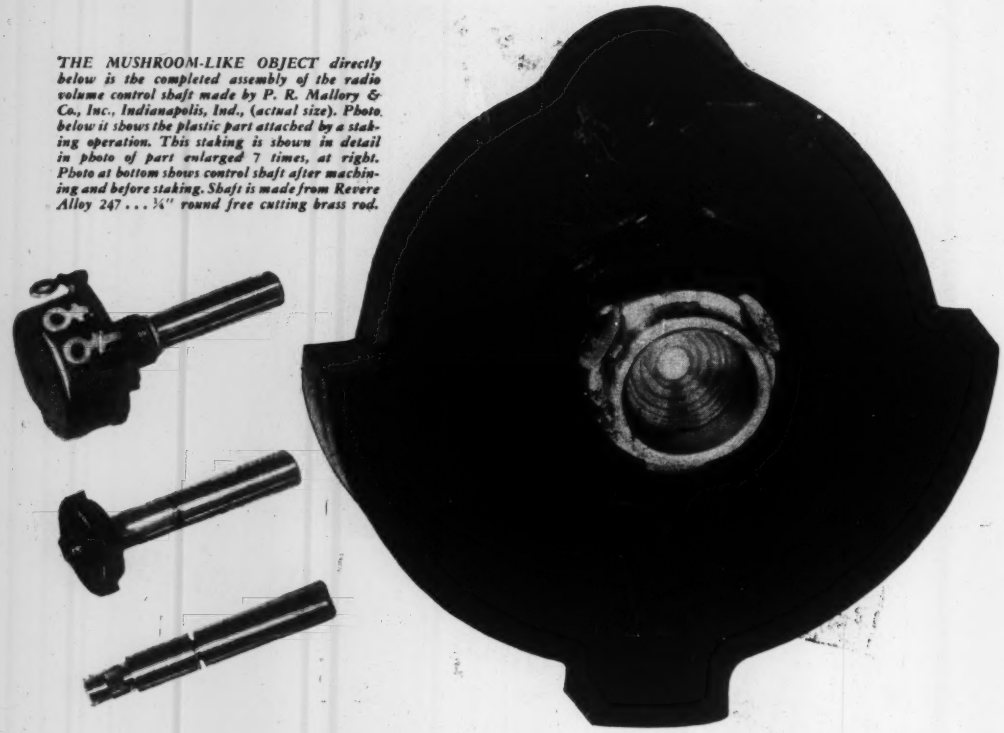
An outstanding advantage of Cleveland's new ND vertical worm gear speed reducer is its low height. Installed on this 1,000 gallon mixing kettle, the ND unit adds only 16 inches to over-all height—no more than that of the motor.

The ND reducer and its companion NU unit (with drive shaft upward) are available in seven sizes each. Because of their several unique construction features, they will give efficient, trouble-free service on such equipment as agitators, mixers, overhead chain conveyors, etc., wherever vertical drives without outboard bearings are desirable.

For complete description, capacity charts and other engineering data on types ND and NU, write for our Bulletin 125. The Cleveland Worm & Gear Company, 3264 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited

THE MUSHROOM-LIKE OBJECT directly below is the completed assembly of the radio volume control shaft made by P. R. Mallory & Co., Inc., Indianapolis, Ind., (actual size). Photo below it shows the plastic part attached by a staking operation. This staking is shown in detail in photo of part enlarged 7 times, at right. Photo at bottom shows control shaft after machining and before staking. Shaft is made from Revere Alloy 247 . . . ¼" round free cutting brass rod.



BY SWITCHING TO REVERE FREE CUTTING BRASS ROD P. R. MALLORY & CO., INC.,

SAVES ON 2 COUNTS!

Staking operation on radio volume control shaft performed without fracture . . . annealing operation eliminated.

The solution to the Mallory Company's problem was not as easy as it might appear. It was not simply a case of Revere Technical Advisory Service recommending ¼" round, free cutting brass rod. That rod had to possess the machinability to match Mallory's existing production machine set-up and at the same time be sufficiently workable so that annealing, prior to staking, could be eliminated; and that staking be accomplished without fracturing the metal.

After consulting with the Mallory Engineers, and discussing the tests which Mallory would subsequently conduct, Revere recommended a ¼" round, half hard riveting and turning rod mixture 247. Working tests made by Mallory showed this rod to possess all the necessary requirements.

As a result of those tests, P. R. Mallory & Company is now using this Revere free cutting brass rod to its complete satisfaction for the radio volume control shafts it manufactures. Not just any ¼" brass rod, but the *right* rod made it possible for them to save on 2 counts.

Perhaps Revere has a brass, a copper or some special alloy to help you in the development or improvement of your product . . . in cutting your production costs. So why not tell Revere *your* metal problems? Call the Revere Sales Office nearest you today.

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YOU CAN BE **SURE**.. IF IT'S

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"DUST STORM". Abrasive dusts sprayed on the Type E, while operating at full speed, for extended periods, fail to impair operation. In these tests, none of the abrasive entered the bearing housing . . . governing and overspeed-trip mechanisms continued to operate freely.

Defies dust and dirt

Depend on the general-purpose Type E Turbine for the kind of service you want . . . whenever and wherever you want it.

Prolonged exposure to abrasive dusts fails to more than dirty up the outside casing. Type F construction keeps foreign matter out, and eliminates close-sliding fits. Materials used in construction resist corrosion and erosion . . . you get a turbine that's *rugged.*

Investigate these, and all the other vital features wrapped up in industry's *standard* turbine . . . the Type E. Get complete information from your nearby Westinghouse office, or write for your copy of the Type E Turbine Book, B-3896. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-50300-A

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ERIE CITY KEYSTONE STEAM GENERATOR

- A 2-drum water tube boiler + automatic oil and gas burner + induced draft fan + operating and safety controls.

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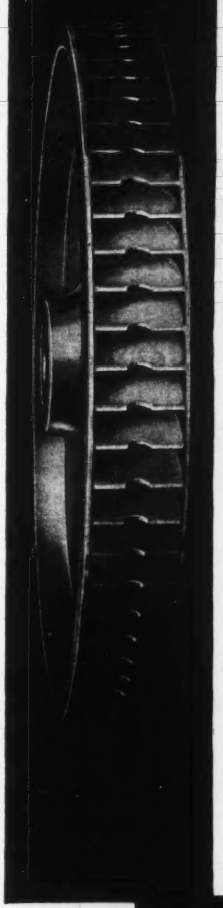
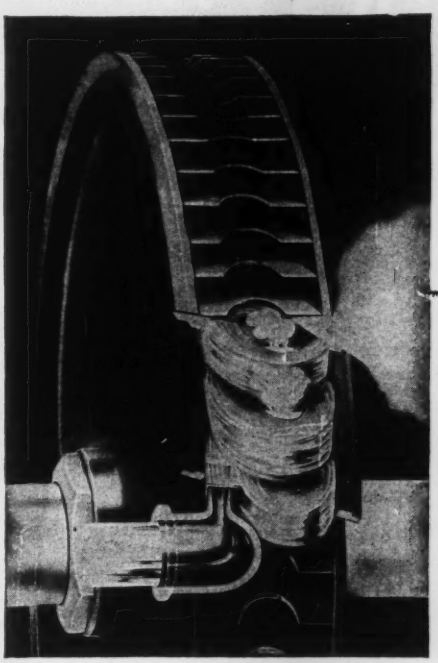
TERRY





Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

NO PARTS TO LOOSEN OR WORK OUT

The rotor of the Terry Wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the solid curved backs of these buckets or pockets. Therefore close clearance is unnecessary and wear on the blades forming the pockets is of little consequence, as it does not materially affect horsepower or efficiency.

For detailed information about this effective construction and its advantages, write us on your business letterhead for a copy of Terry Turbine Bulletin S-116.

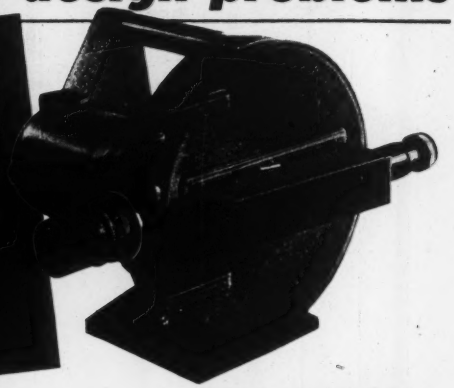
T-1172

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

FOR ENGINEERS with design problems

it's FASTAX

the WORLD'S FASTEST moving film cameras with the GREATEST OPERATING SPEED RANGE



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The Taylor TRANSET* Control System

- **MORE ACCURATE MEASUREMENT**
- **CLOSER CONTROL ON ANY PROCESS**
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- **HIGHER PROCESSING EFFICIENCY**

Taylor has developed a new controller and a new recorder to take full advantage of faster measuring devices, such as TRANSAIRE* Temperature and Pressure Transmitters and the Aneroid Manometers for Flow and Liquid Level. Each takes advantage of the other's superior performance. **Now available in a complete system.** The result—unprecedented quality of process control.

1. FASTER MEASURING INSTRUMENTS. Taylor's TRANSAIRE, force-balance temperature or pressure transmitters, created new standards in the measurement of *changing or dynamic* temperatures and pressures. With derivative action (SPEED-ACT*) in the measuring system, they transmit process changes with unbelievably fast accuracy. Many other features.

2. FASTER CONTROL with Stability! Taylor's new TRI-ACT* Controller combines a wider range of response adjustments, an increased capacity relay air valve, and a *new control circuit*, to take advantage of the faster measuring systems. This new force-balance controller permits 4 times faster reset rate and 4 times faster rate action (PRE-ACT*) than conventional controllers. No overpeaking. Faster recovery for load changes on pressure, flow, and temperature applications—because rate action is in *the new circuit*.

3. MIDGET RECORDER saves space. New TRANSET Recording Receiver greatly reduces panel space. Fits 3⅞" x 4½" panel opening, making it especially adaptable to graphic panels. Gives continuous 30-day process record, with 3 hours visible—remote setting of control point—automatic to manual control—instant check on controller performance and the control valve position.

We sincerely believe this new Taylor-engineered TRANSET Pneumatic Control System combines *the best transmitter, the best controller, and the best recorder* on the market. Find out more about it, and put it to work for you! Write for **BULLETIN 98097,** and ask your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.

Taylor's Centennial — ACCURACY FIRST SINCE 1851

TRANSAIRE ➔ TO TRI-ACT ➔ TO TRANSET

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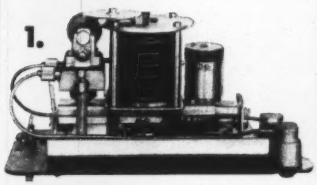

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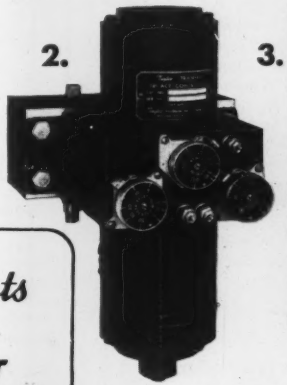

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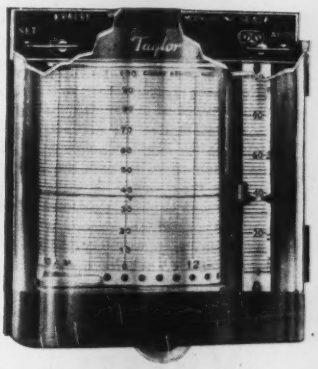


Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

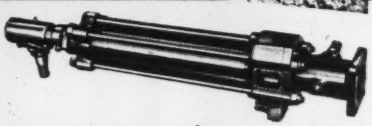
1. TRANSAIRE force-balance temperature or pressure transmitter with SPEED-ACT gives rate action in the measuring circuit. **2. TRI-ACT Controller.** Has high capacity relay air valve for faster response to new control circuit. Wider response adjustments. **3. TRANSET Recorder.** Fits 3⅞" x 4½" opening . . . a "natural" for graphic panels; a great space saver for conventional panels.

Lull Traveloader

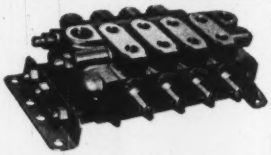
Lull Shoveloader

MORE Cost-Cutting APPLICATIONS OF VICKERS HYDRAULICS

Vickers Hydraulic Equipment plays an important part in the performance records that are being reported on these two popular types of materials handling machines. Illustrated below are representative Vickers units used by Lull . . . all are built especially for mobile equipment. These hydraulic controls offer many advantages to both the equipment user and the manufacturer. They assure quick and accurate response to the operator with negligible physical effort . . . they provide inherent overload protection against abuse of equipment . . . they simplify design and save space. Ask the nearest Vickers Application Engineer to call for a discussion of your product improvement problems.



Vickers Steering Booster provides hydraulic power instantly (with no more effort than a "trigger pull") to meet any steering requirement for better maneuverability of loaders with heavy loads on steering axle.



Vickers Multiple Unit Valves consist of individual operating valve sections, assembled in almost any combination (up to 10 sections) for various hydraulic control functions. Vickers exclusive porting arrangement and fully balanced design provides sensitive positioning under actual operating conditions . . . unaffected by surges.

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
1500 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI CLEVELAND • DETROIT • HOUSTON • LOS ANGELES (Metropolitan) • MILWAUKEE NEW YORK (Metropolitan) • PHILADELPHIA • PITTSBURGH • ROCHESTER ROCKFORD • ST. LOUIS • SEATTLE • TULSA • WASHINGTON • WORCESTER

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Hounded by tubing problems?

Bundyweld Tubing, double-walled from a single strip. Exclusive, patented beveled edge affords smoother joint, absence of bead, less chance for any leakage.

Nothing will get you up a tree faster, competitively speaking, than a tubing part that can't hold its own in your product.

Like a coil that won't curl up and behave. Or a line that bursts under normal pressure. Or a unit that tires out after a short shimmy. If you're hounded by these or other problems in your applications of small-diameter tubing, it will pay you well to check into Bundyweld, the multiple-wall type of Bundy® tubing.

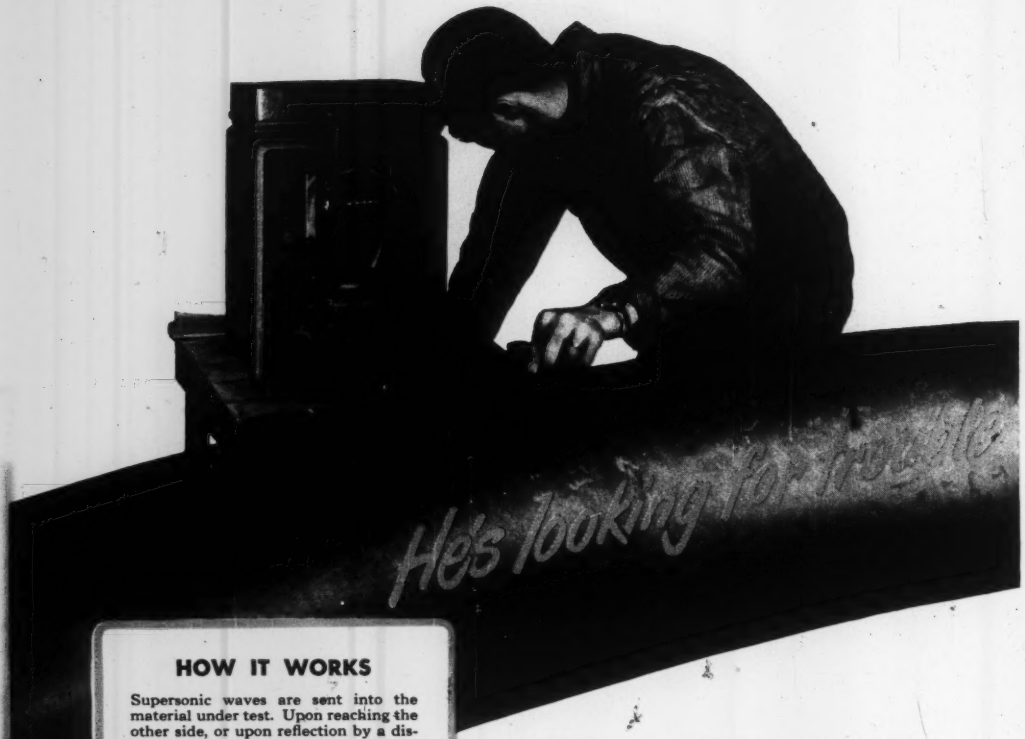
Double-walled from a single strip, with exclusive beveled edge, Bundyweld has no peer in its field.

Bundy Tubing Company

DETROIT 14, MICHIGAN

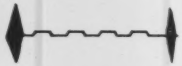
World's largest producer of small-diameter tubing

AFFILIATED PLANTS IN ENGLAND, FRANCE AND GERMANY



HOW IT WORKS

Supersonic waves are sent into the material under test. Upon reaching the other side, or upon reflection by a discontinuity, the waves return to their source and are then converted into a high-frequency potential. This potential is amplified by electronic circuits and projected upon the screen of a cathode-ray tube where they may be seen and examined.



Pulse pattern, showing the initial pattern at the extreme left and the reflection from the opposite side at the extreme right. The sweep line indicates no defects.

A typical indication of a defect is illustrated here. By means of calibration, it is now possible to determine both the exact position of the flaw, as well as its size.

Today, Supersonic testing is available on specification for inspecting Grinnell prefabricated piping. By observing the pattern produced by the electron beam on the fluorescent screen, any defects in the base metal, welds, or variations in pipe thickness can be located and measured at a glance.

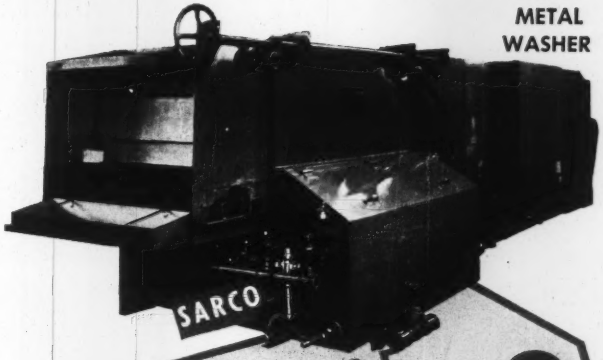
Grinnell's ultra modern electronic testing can be relied upon to detect hidden flaws in pipe materials, to check unerringly the quality of welds where it picks up types of flaws not revealed by X-ray and gamma ray inspection. In examining bends, this type of testing can measure the degree to which bent pipe thins on the outside and thickens on the inside of the bend, assuring full specified thickness in high temperature, high pressure work.

Non-destructive Supersonic testing is another in a constant succession of new techniques employed by Grinnell to provide prefabricated piping which is safe and dependable . . . which measures up in every way to *rigid* state, national, association and insurance code requirements. It is another reason, too, why it will pay you to think of Grinnell "Whenever Piping Is Involved".

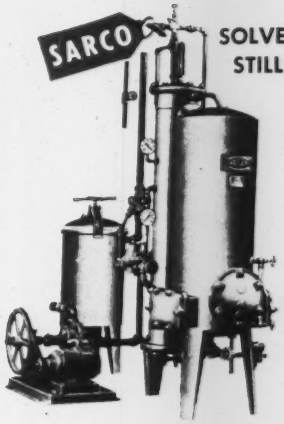
GRINNELL

WHENEVER PIPING IS INVOLVED

GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane



METAL WASHER



SOLVENT STILLS

A MARK OF DISTINCTION

When you buy steam equipment

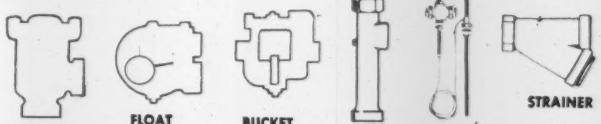
Equipment on which
SARCO
is standard

WATER HEATERS
•
BOTTLE WASHERS
•
CAP SEALERS
•
DEGREASERS
•
AIR CONDITIONERS
•
SOLVENT STILLS
•
AIR COMPRESSORS
•
OVENS & BOILERS
•
LAUNDRY MACHINERY

Why is it that more than 100 manufacturers of steam operated machinery prefer to equip with Sarco steam traps, temperature controls or strainers before the equipment is shipped? The answer is simple. After years of tests in their plants and in the field they know that their machines will produce more with less steam and fewer service calls.

Isn't that exactly what you want from *all* the steam equipment installed in your plant? If so, all you have to do is to insist on "Sarco Equipped" when you buy new machinery or modernize your present equipment.

A few of the Sarco products supplied with new equipment are illustrated below. For complete information write for Catalog No. 200.



THERMOSTATIC TRAP | FLOAT TRAP | BUCKET TRAP | LIQUID EXPANSION TRAP | TEMPERATURE REGULATOR | STRAINER

317

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

New... A DRAWING PENCIL

The all-new

Test 3-against-3

Let us send you, without cost, 3 MICROTOMICS of any *one* degree. Test them for uniformity against 3 of your present pencils of the same degree. See for yourself why only MICROTOMICS can make this sensational offer.

EBERHARD FABER PENCIL COMPANY
37 GREENPOINT AVENUE, BROOKLYN 22, N. Y.

I'll accept your FREE TEST offer. Send me 3 New MICROTOMIC Drawing Pencils. I'll test them for uniformity against my present pencils. The degree of my choice is .....

Name .....

Firm .....

Street & No. .....

City ..... *State* .....

THAT DELIVERS ABSOLUTE UNIFORMITY

MICROTOMIC

Test 3 . . . test a dozen . . . each pencil of the same degree is always identical! Newly-developed quality controls enable Eberhard Faber to keep every New MICROTOMIC reliably uniform. If you have been annoyed by grade markings that don't mean what they say, try the "3-against-3" test and see why the all-new MICROTOMIC is the drawing pencil of the future.

AS SUPERIOR IN PERFORMANCE AS IS PROMISED IN ITS "NEW LOOK"

New Dusk Gray color chosen by hundreds of draftsmen—distinctly different—less distracting. Quicker to find on any drawing board. New "bullseye" degree markings on 3 sides make it easier to read—never any uncertainty when you reach for a MICROTOMIC.

Sharper prints resulting from HI-DENSITY opaque lines, lines that reproduce dead-white when subjected to the actinic rays of high-speed "printers"—no feathering, no blurry edges! HI-DENSITY leads are stronger too, because of their physical structure—and do away with excess point-crumbling and line smudging.

Free Test Samples—Mail Coupon Opposite!

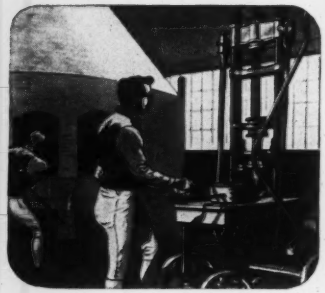
MICROTOMIC Leads in wooden case with sandpaper covered side for convenience in pointing.

New Dynamic Balance Lead Holder. Feather light . . . grips all size leads perfectly. Comes with extra clutch. Color-coded caps identify degrees.

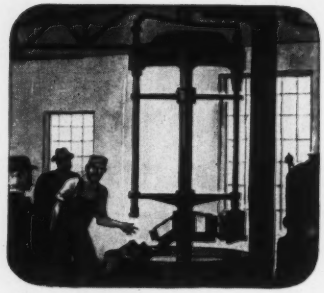
EBERHARD FABER *Since 1849*

TRADE MARKS REG. U. S. PAT. OFF.

1 1621—Glass was money! America's first glass factory was actually a mint—not for the manufacture of coins but to make glass beads for *use* as money when buying land, food and furs from the Indians.



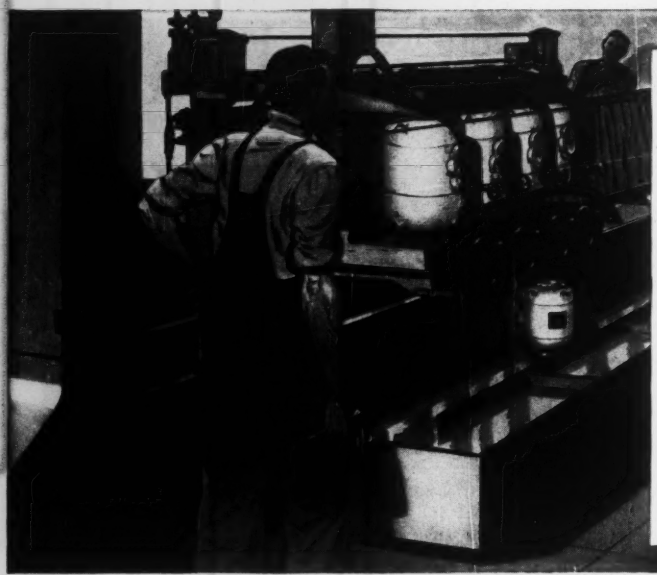
2 1827—Blown glass was the rule until Enoch Robinson, a carpenter, figured glass could be *pressed* into shape . . . the glass pressing machine was born. Electricity to power new machines was still to come.



3 1899—Owens invented a machine to make bottles as the machine age arrived in glass. By 1915, Howell "Red Band" Motors were making important contributions to this and other industries.

ANOTHER HOWELL SUCCESS STORY

GLASS...from artisans to automatic machines



4 Today—Modern, electrically driven machines have improved quality, cut costs and increased output in the glass making industry. For example, this unique glass beveling machine, equipped with 7 dynamically balanced Howell Motors, *automatically* bevels glass at the rate of 2,000 inches per hour!

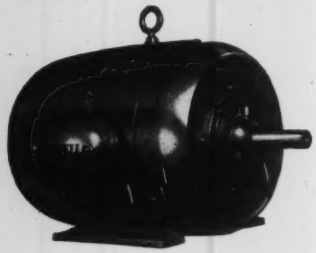
You'll also find precision-built Howell Industrial Type Motors powering bottle and bulb machines, conveyors, grinders, polishers, plate and window machines in the glass industry.

Elsewhere, Howell's wide range of standard NEMA motors, and special motors designed to customer requirements, serve dependably and efficiently under the toughest conditions.

For a really profitable investment, buy HOWELL!

Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.

Howell totally enclosed, fan-cooled motor—windings completely sealed against dirt and weather.



HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built Industrial Motors Since 1915

HOWELL Red Band MOTORS

Metallurgy

Craftsmanship

Tolerance Control

8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

Integrity

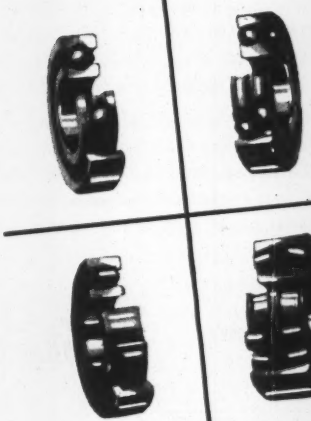
Product Uniformity

Field Service

Engineering Service

Surface Finish

make preference for a reason your guide when you specify ball and roller bearings

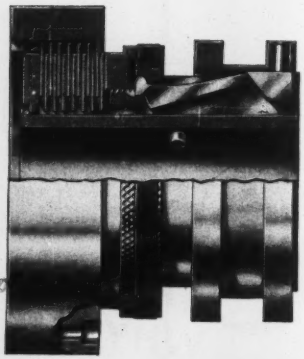


Over the years, products acquire a value above and beyond their mechanical qualities—a value proved by their *acceptance* throughout industry. This is especially true of SKF ball and roller bearings, preferred by all industry for one or more of eight good reasons. So when you specify, let preference be your guide. 7200

SKF
BALL AND ROLLER BEARINGS

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.
—*manufacturers of* SKF *and* HESS-BRIGHT *bearings.*

MAXITORQ



in the MINING FIELD

We are pleased this month to pay tribute to the Joy Mfg. Co., Pittsburgh, Pa., for its remarkable 18-HR-2 Rock and Ore Loader... and to express our gratification for their selection of Maxitorq Clutches as original equipment.

Two double No. 27 Maxitorq floating disc Clutches ... one for each crawler tread... control the power for independent forward and backward movement that permits precision maneuvering and positioning of the loader.

Only a ruggedly-built clutch can stand up under the tough going of this "battleship" machine that loads up to *12 tons of ore per minute.* Maxitorq is taking the job in its stride.

If you have a tough job requiring positive clutch action and long life... or an application calling for overload protection of a shear pin nature... ask our engineers for practical recommendations. Within its capacity (to 15 H.P. at 100 r.p.m.) there's no finer clutch made.

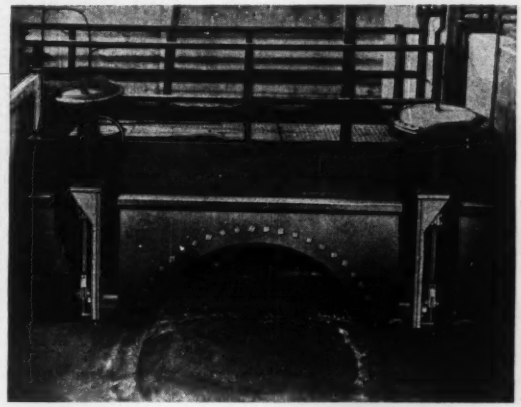
Send for Catalog No. ME1

BCJ50

THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER • CONNECTICUT

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



AUTOMATIC CONTROL of Industrial Sewage

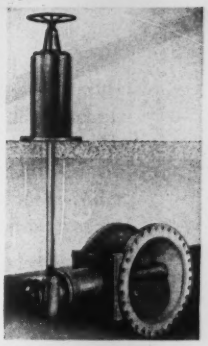
Photograph shows R-S 60-inch Valve discharging sewage from an oil refinery. The valve is operated by means of dual air diaphragm top works and stainless steel linkage, with a handwheel for emergency operation. By means of a level device, the valve is automatically closed at high tide thus eliminating the possibility of flooding the refinery. Valve opens automatically should the air pressure fail. Under emergency conditions or should all power fail, one man can close the valve with a few turns of the handwheel.

R-S Valves are used in air, gas, liquid, steam and semi-solid service in the pressure range from 2 to 2500 psig. They are available in sizes from 2-inches to 72-inches and larger for the simplified control and shut off of volume and pressure.

Consult with your local R-S Valve Engineers or write direct.

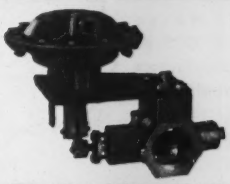
R-S PRODUCTS CORPORATION
4600 Germantown Avenue
Philadelphia 44, Pa.

No. 790—Eight-inch Steel Straight Through Slide Valve with pull lever control. Flange on left side when removed permits replacement of slide or cleaning of valve.



No. 788—Fifty-pound Heavy Duty Service Valve with rubber seat. Equipped with totally enclosed gear reduction drive, extended shaft and floor stand.

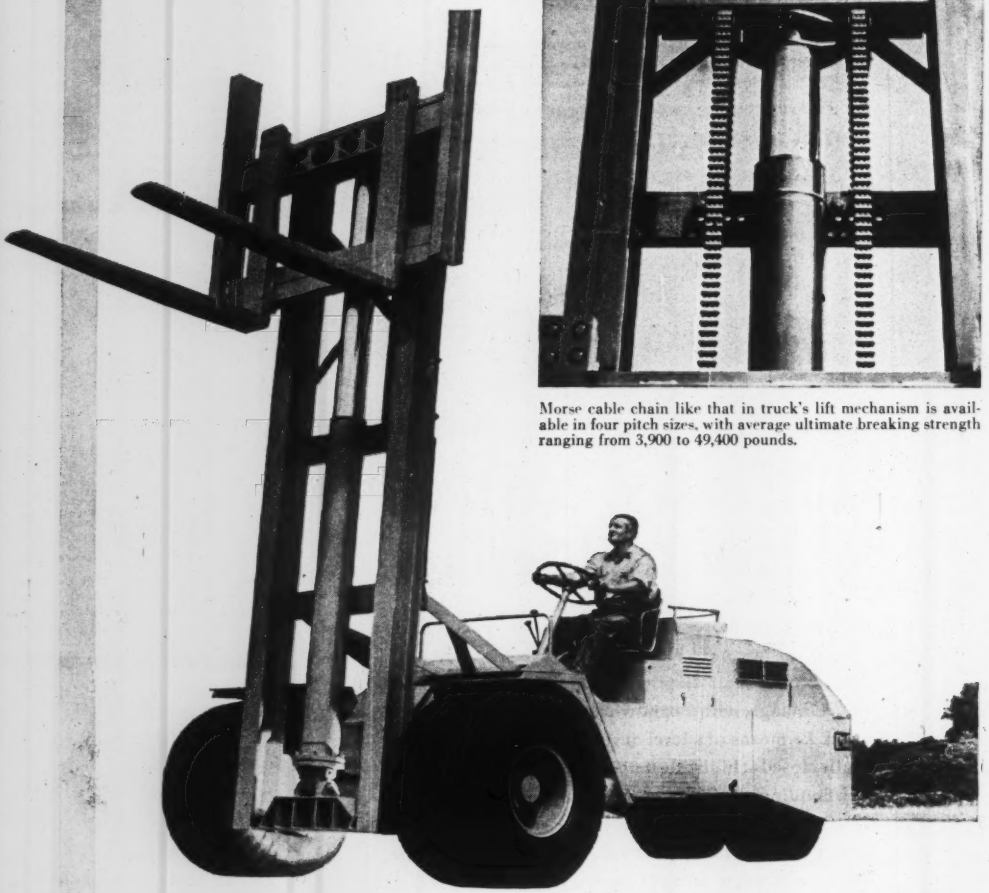
No. 769—Steel Off-center Relief Valve for low pressure drop. Hand lever can be used as an instrument lever. Counter weight on right side of valve. Relieves at 1 psi differential pressure.



No. 778—Two-inch Threaded End Valve complete with bracket and diaphragm top.

Giant fork truck

Morse cable chain like that in truck's lift mechanism is available in four pitch sizes, with average ultimate breaking strength ranging from 3,900 to 49,400 pounds.

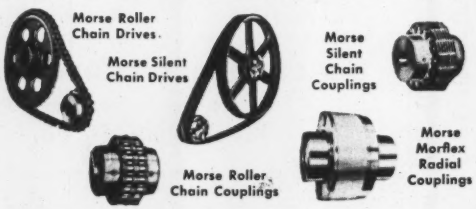


Tough-built Morse roller chain drives give you on-the-job stamina and long life. They use teeth, not tension. Morse roller chain drives are positive, can't slip. They are 99% efficient.

Ask the Morse Man for power transmission information!

100 Morse Branch Offices and Distributors to supply your power transmission demands.

From coast to coast there are more than 100 offices, representatives and distributors of Morse Power Transmission products to give you quick information and service when you want it—where you want it. *Ask the Morse Man first in any case!* Check your classified phone directory under **"Power Transmission"** or **"Chains"** for the nearest Morse Man.


Morse Roller Chain Drives
Morse Silent Chain Drives
Morse Silent Chain Couplings
Morse Roller Chain Couplings
Morse Morflex Radial Couplings

gets lift from MORSE CHAINS...

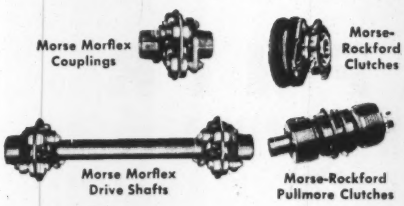
THE huge Ross truck at left, world's largest on pneumatic tires, lifts, moves, and stacks a thirteen-ton, six-foot-wide load, ceiling high at low cost. Everything about this machine smacks of power, power, power. And transmitting power efficiently, safely, reliably are two types of Morse chain: Morse cable chains, in the lift mechanism; two Morse double roller chain drives, from the differential drive axle to the front wheels.

Whatever your power transmission problems — whether they call for cable chain, roller or silent chain drives, clutches, couplings, or drive shafts — turn to Morse as Ross has. For complete information, write

MORSE CHAIN COMPANY
Dept. 105 • 7601 Central Ave., Detroit 8, Michigan

M=PT
BASIC FORMULA

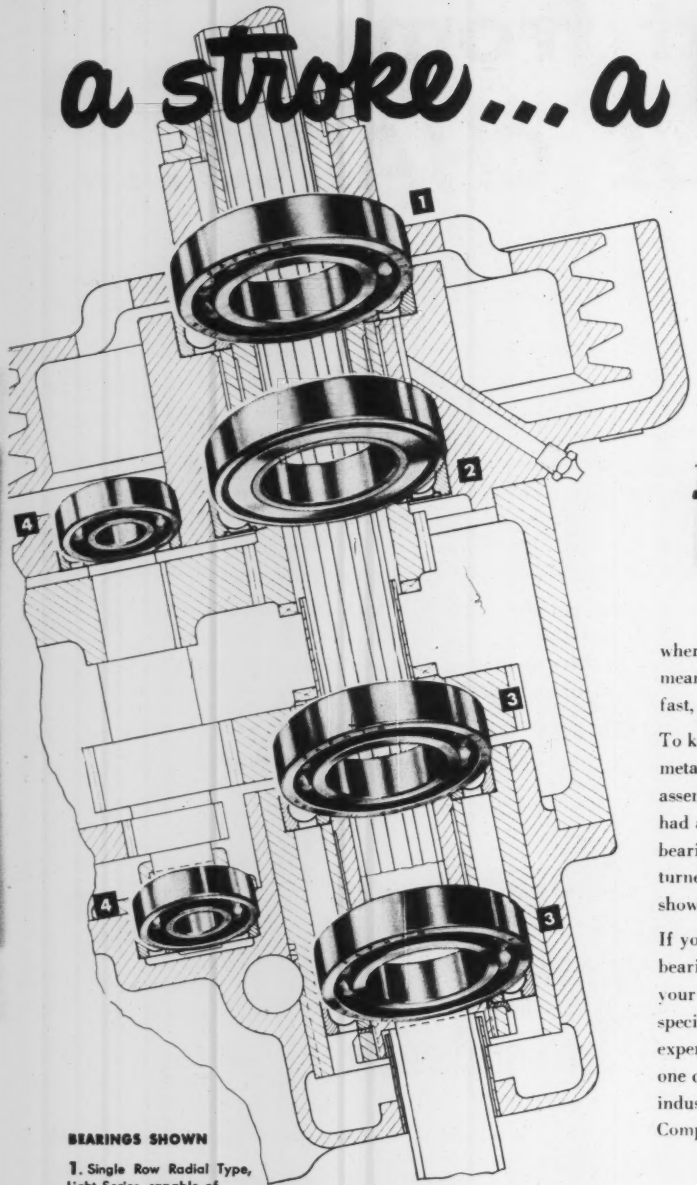
Morse *means* Power Transmission

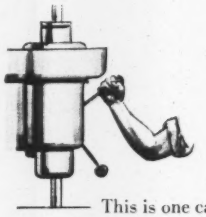


MORSE
MECHANICAL POWER TRANSMISSION PRODUCTS

PRODUCTS OF B-W BORG-WARNER

a stroke... a hole





This is one case where a stroke a hole does not mean a handicap. Instead, it means fast, uninterrupted drilling.

To keep up such a pace in any metal, the maker of this power feed assembly for a drill press knew he had a tough holding job for ball bearings . . . a problem which he turned over to Fafnir. The solution — shown here — worked perfectly.

If your product calls for ball bearings you, too, will find it to your advantage to call in Fafnir specialists because Fafnir's experience is not limited to just one or two industries but is industry-wide. The Fafnir Bearing Company, New Britain, Conn.

BEARINGS SHOWN

1. Single Row Radial Type, Light Series, capable of carrying radial, thrust or combined loads in any direction.

2. Same as above with single grease shield added.

3. Same as No. 1 except the size of bore.

4. Single Row Radial Type, Medium Series. Heavier cross-section than the Light Series . . . capable of withstanding heavy shock loads.

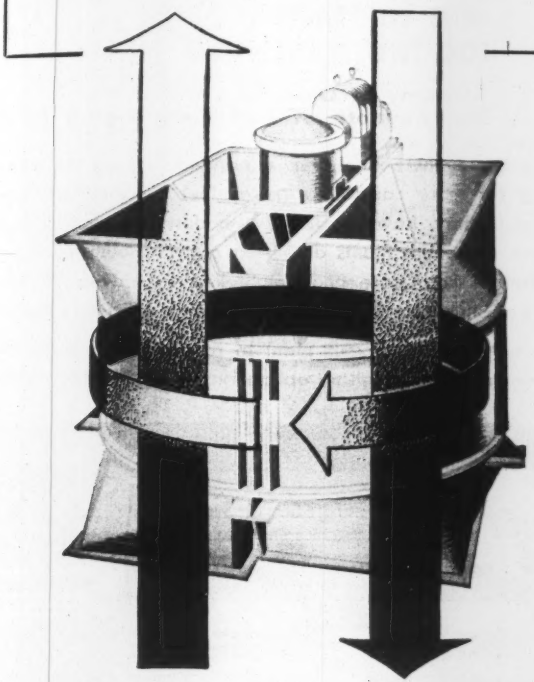
FAFNIR

BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

Increase the efficiency of your present boiler

with the *Ljungstrom* AIR PREHEATER



The installation of a Ljungstrom air preheater on your present boiler offers the opportunity for considerable fuel savings that will more than offset the initial cost of the preheater in a matter of a few years.

The regenerative counterflow principle of the Ljungstrom permits operation at lower exit gas temperatures . . . assuring increased heat recovery and reducing the amount of fuel required. Moreover, the compactness and lightness of the preheater makes it possible to install it on your present boiler with minimum change in the existing structure.

For more information as to how you can approach modern performance standards with a boiler that is operating without an air preheater, or with out-of-date air preheater, write to the Air Preheater Corporation. Our engineers will welcome the opportunity to show you how the Ljungstrom can raise the over-all efficiency of your plant.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

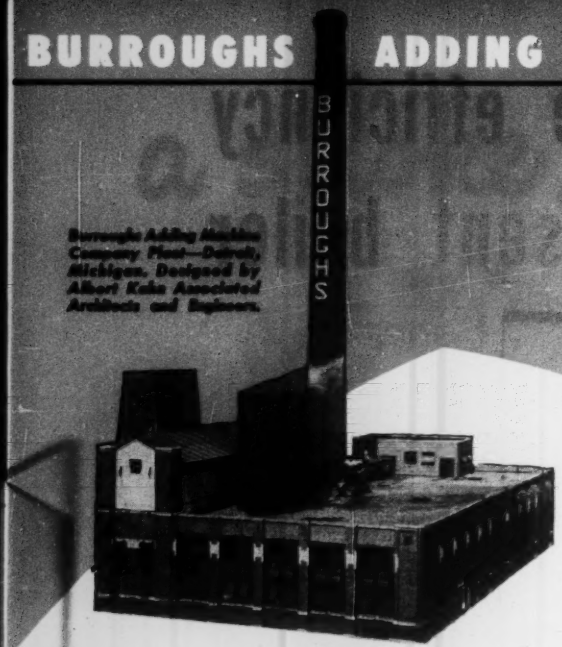
60 EAST 42nd ST. • NEW YORK 17, NEW YORK

BURROUGHS ADDING MACHINE COMPANY

have used

DETROIT STOKERS

for 33 years



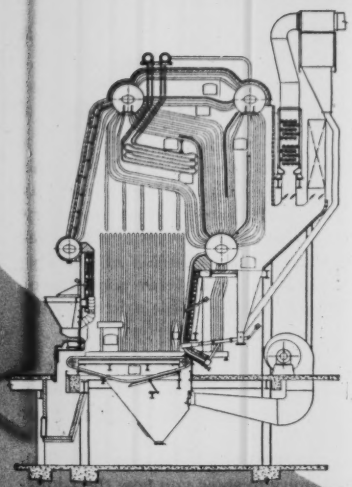
Burroughs Adding Machine Company Plant—Detroit, Michigan. Designed by Albert Kahn Associated Architects and Engineers.

NINE CONTRACTS FOR TWO PLANTS SINCE 1917

Economy of Operation
The Keynote of Burroughs Buying Policy

As the Burroughs business has expanded through the years, calling for more capacity; and as fuel specifications have changed, they have continually modernized with Detroit Stokers. Burroughs Plants at Detroit and Plymouth, Michigan, use Detroit RotoGrate and RotoStokers exclusively. A wide range of bituminous coal and coke breeze is efficiently burned.

Why not modernize your plant to reduce steam costs. Our recommendations entail no obligation. Write for information.



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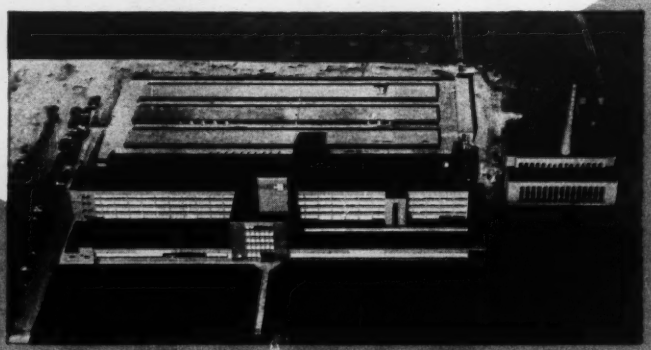

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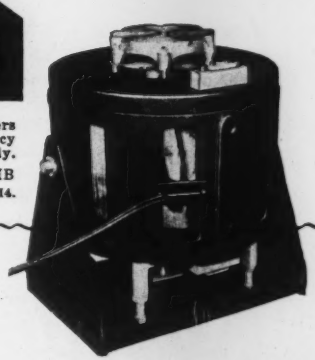

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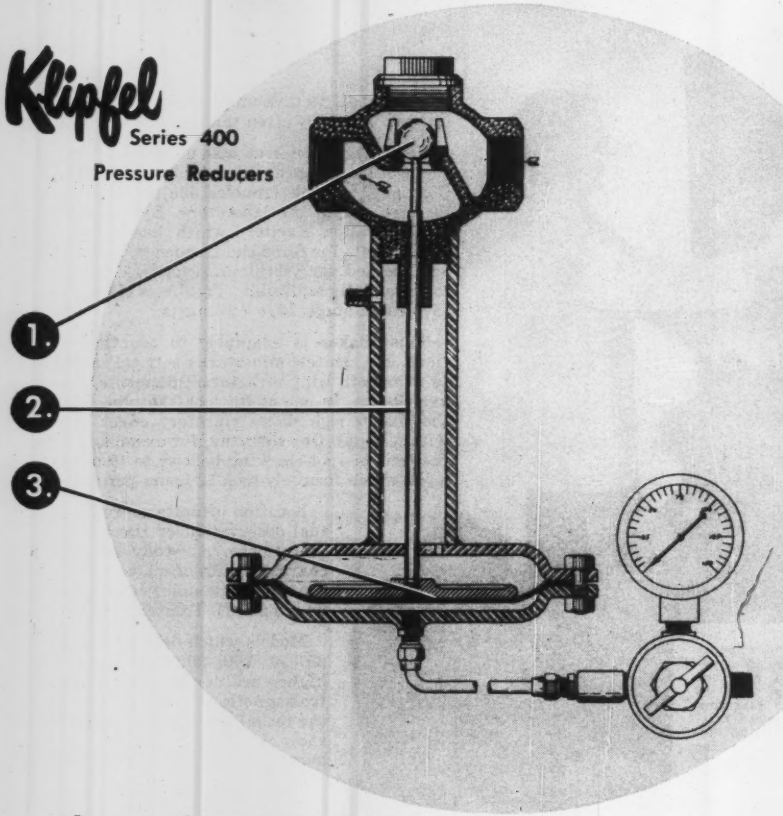

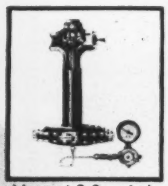

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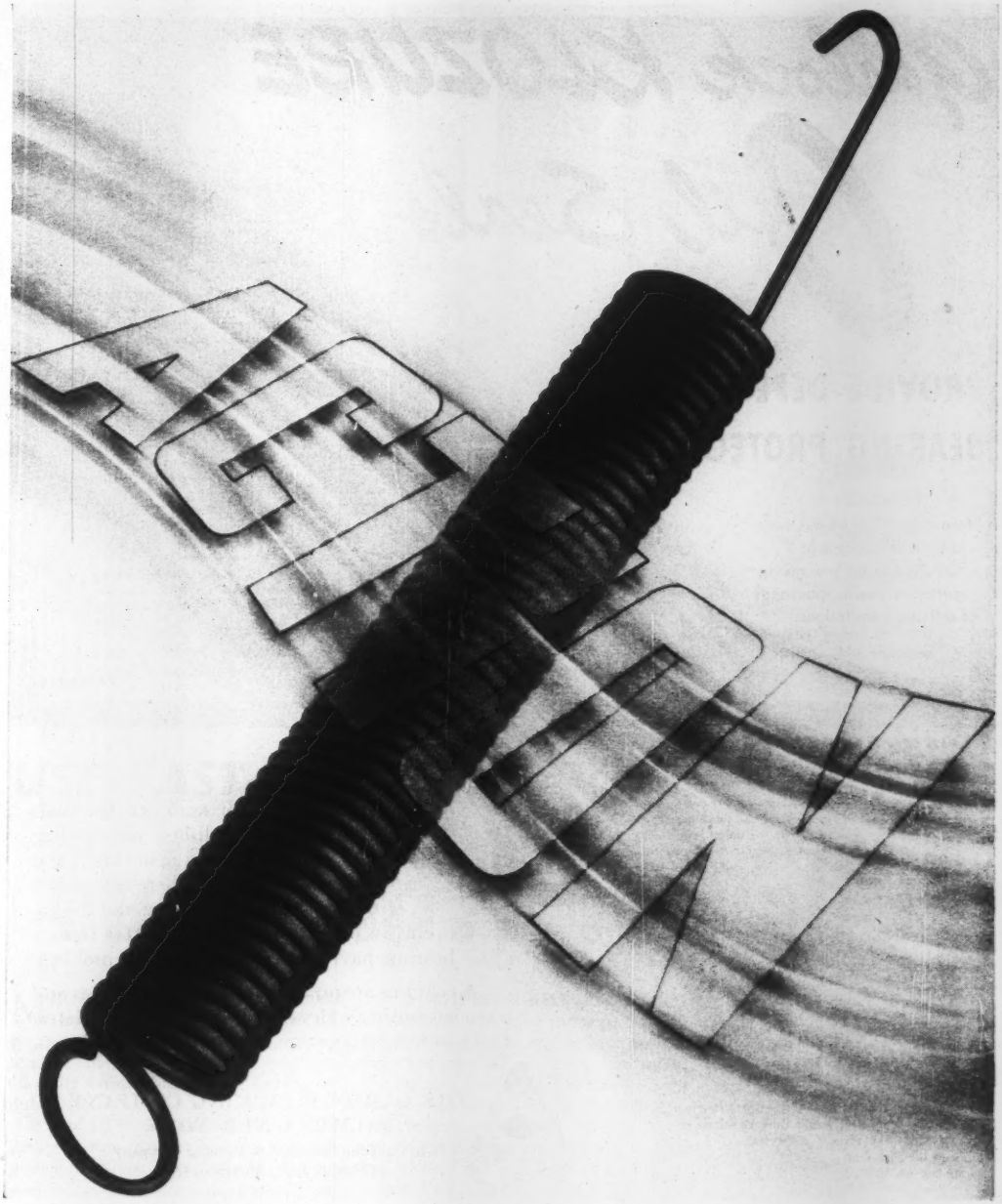

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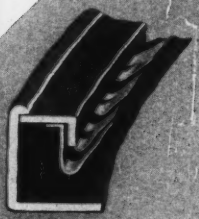

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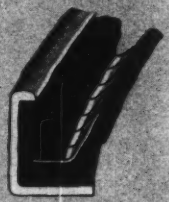

Model 63—An efficient, general purpose seal for high speeds. For shafts 3" dia. and smaller.

Above—Model 91B—A spring-loaded seal of small cross section, with the metal reinforcing member surrounded by rubber.

Below—Model 91A—A springless seal of small cross section, with the metal reinforcing member surrounded by rubber.

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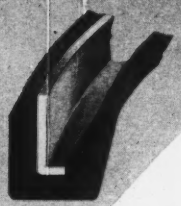

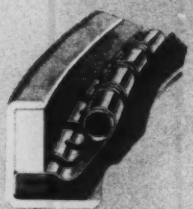

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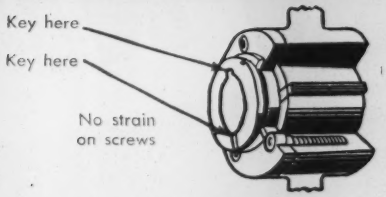

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MECHANICAL ENGINEERING

Published by The American Society of Mechanical Engineers

VOLUME 73 NUMBER 1

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Howard Coonley

(Mr. Coonley's address, delivered on November 29 at the 1950 ASME Annual Dinner, will be found on pages 3, 4, and 16. On that same day he was honored at a luncheon of the American Standards Association as the first recipient of the Howard Coonley Medal of the Association. On the previous day he presented a paper at the Management–Production Engineering session of the 1940 ASME Annual Meeting entitled "Standards Aid Quality Control." He has been an Associate of the ASME since 1917.)

The ROLE *of* CONSERVATION *in* MOBILIZATION PLANNING

By HOWARD COONLEY

CONSULTANT, NATIONAL SECURITY RESOURCES BOARD, WASHINGTON, D. C. MEMBER ASME

CONSERVATION is not an American characteristic. Our people have ingenuity, adaptability, and driving power, but we are not by nature accustomed to make much out of little, to see how far we can stretch the cloth which is within easy reach. In short, we lack a spirit of thrift. It should not require a war or even a threat of war to make us aware of the necessity to save.

When I sat down to consider how I could impress upon this audience tonight their responsibility for the conservation that is essential if our country and our way of life are to survive, I realized that it would be wise to turn to our benefactor Noah Webster to define the word I am using as my text. The result of my investigation was not completely satisfying. Noah says: Conservation is, first, a process of conserving or preserving; second, official care or supervision as of a river or forest; third, keeping as of bees or domestic animals; and, fourth, making of conserves or preserves.

The conservation that I have in mind goes far deeper than these definitions. In our present crisis it is the ingredient that will expand the output of our mills and our machinery that urgently important additional amount which is needed to take care of civilian as well as military requirements, and thereby safeguard our republic and assure the survival of the democratic nations of the world, whether our destiny be the terrors of another war or the blessings of long years of peace.

I am undertaking tonight to tell you briefly what your Government's present program is in the field of conservation and what is proposed for the future.

SIX ASPECTS OF CONSERVATION

The National Security Resources Board, to which I am giving a substantial portion of my time as Chief Conservation Planning Specialist, is not an operating agency such as was the War Production Board. Its responsibilities and its authorities are limited to the area of mobilization planning, to the co-ordination of Government activities, and to the inauguration and stimulation of such activities where necessary.

Conservation as practiced in World War II and as it must be considered in mobilization planning may be divided into six broad categories.

First on the list I should place standardization. Perhaps I should combine with standardization, specifications, for in Washington the two have quite different meanings. There, specifications are thought of as schedules set up for immediate production and procurement; standards are rules and regulations designed for longer-term use. They have the framework of permanency. Simplification is an important corollary of standardization. In these areas of standardization, specifications, and simplification, our ASME is deeply interested and plays a vital role.

My second category might be stated as measures to determine and safeguard supplies of critical materials. This is a subject that should have our complete backing whether or not an emergency is threatened.

Third on my list is the development of substitutes wherever necessary and possible. This should be the natural habit of prudent industrialists.

In fourth position I place a program of salvage and savings at the source.

Fifth is a cataloging of supplies under a system of standard identification to avoid duplication and waste.

And last but not least I place international co-operation in conservation measures. And I say last but not least deliberately, for it is my firm conviction that lasting world peace must be built upon an interchange of goods, services, and techniques on a basis of mutual benefit and friendly understanding.

In a brief statement of this kind I can only touch the high spots of my subject. Yet you should know and I hope you will approve and support the measures that are being taken.

USE BEING MADE OF RETIRED EXECUTIVES

The handful of specialists (I feel I can properly call them experts) that are responsible for the National Security Resources Board's conservation activities have been (with one exception) recruited from that great group of recently retired executives who are still charged with the necessary physical energy, and who have the priceless attributes of experience and knowledge to make them outstandingly valuable to our conservation planning efforts. I am letting no opportunity go by to recommend to other Government agencies that they turn to the rich field of the recently retired for the assistance they need in their expanding activities. I am further tempted to pause in my thesis long enough to say that it would be well, as it may be necessary, for our leaders of business to reappraise their theories of the mandatory retirement age for members of their organizations. One of the outstanding industrial economists attached to a great and successful corporation tells me that a recent survey indicates the useful years of life of our men and women workers are rapidly increasing due, undoubtedly, to greater understanding of proper foods and broader knowledge of preventive medicine. He predicts that within the next generation the period of efficient service will have increased by fifteen years over our earlier estimate. I believe it is in a large part due to the wisdom and maturity of our little band of "Minute Men" that we have been so universally welcomed by all Government agencies.

FUNCTION OF THE CONSERVATION SPECIALISTS

But to return to the work being done by our small group of specialists; our main duty is to keep open the channels of contact with all Government agencies to learn what each is doing in the area of conservation; to assist wherever possible; to offer suggestions where they are sought or needed; to develop methods of co-ordination and stimulation.

One of the first groups with which I became associated after I came to Washington in March of this year was the Interdepartmental Standards Council. In December, 1949, this

An address delivered at the Annual Dinner and Honors Night, New York, N. Y., Nov. 29, 1950, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Council was set up to co-ordinate and direct the standardizing activities of all Government agencies and to prevent duplication and discrepancy. Sixteen Federal agencies, both military and civil, are represented on this Council, of which S. J. Kaidanovsky of the General Services Administration is chairman.

The conservation planning specialists of the National Security Resources Board who have wide industrial experience and many contacts both within and outside of the Federal agencies are very active in the deliberations of the Interdepartmental Standards Council. They have been able to offer guidance on problems of international as well as national scope and to suggest important opportunities for developing standards which justify the attention of the Council. One of their chief concerns is closer co-operation between Government and industry. There is far too little known by one group about the accomplishments of the other in the field of conservation, of which standardization is a tool. A group of liaison engineers such as the conservation specialists can perform a very valuable function in bringing Government and industry closer together for the accomplishment of common objectives.

The most active participation in the Interdepartmental Standards Council on the part of the military comes from the Standards Agency of the Munitions Board of which Col. A. E. Michelsen is chief. This agency is another miniature group whose functions are similar to those of the American Standards Association in that they develop no standards but provide the machinery through which the three divisions of the Department of Defense determine what standards are to be developed, select the members of the committees that do the actual work, and pass judgment on the standards when they are completed.

At the present time the Standards Agency of the Munitions Board is reviewing several of their standards for drawings and drafting-room practices and is planning on an expansion of these standards. In this program, we of the National Security Resources Board are giving them every encouragement. For we can conceive of no conservation measure that would prove of greater value to the mobilization effort than a unified set of industrial-military standards in this important area. Had there been available in World War II such a group of standards, millions of dollars and hundreds of thousands of skilled man-hours would have been saved. As sponsor for A.S.A. Committee Z14, ASME has an outstandingly important position in this area. It is my deep hope that some way will be found for Committee Z14 and the Munitions Board Standards Agency to work together on this project, so that the standards may be truly representative of the best industrial as well as military thinking.

DEVELOPMENT OF A SUPPLY CATALOG

I will not attempt to speak further tonight on the need of a monthly list of critical materials, classified as to their current criticality or on the programs of substitutes for critical materials, on both of which our group is working. It is a matter which I am pursuing vigorously. But I do want to refer to the developments that are under way of a Supply Catalog, to which I referred as the fifth on my list of categories.

Confusion, delay, and unnecessary work were experienced during World War II because of the lack of a common language to describe the Government's supply needs. You all know the now famous story of a combat vessel turning 500 miles off its course to replace a broken bearing only to find that several bearings of the same dimensions were on board but stocked under different item numbers. At one time, eleven naval agencies and three Army agencies attempted to solve this exasperating problem by each developing its own system. Immediately after the war the Secretary of the Navy submitted this problem to the member bodies of the American Standards Association. As a result a standard method of testing bearings has been agreed upon. Another standard on dimensions and tolerances is about to be issued, and a numbering system is approaching completion. The antifriction-bearing incident is one of countless though less striking examples of the difficulties that have arisen because of the lack of a supply catalog.

The need for uniform Federal cataloging has long been recognized. Supply systems of Federal agencies have traditionally contained thousands of apparently different items when in reality many of them were thought to be different only because of the lack of uniform item names, descriptions, and stock numbers. As early as World War I, experience showed that the lack of a common language to identify the same item, or similar items, used by different branches of our Armed Forces, caused duplication and waste.

A Federal Standard Stock Catalog was published in a single series of volumes from 1930 to 1935. These volumes, together with the supplements that followed, contained only 350,000 items. Five million items are included in the supply lists of today. Use of this first catalog was limited to a few Government agencies that found it practicable to adopt a uniform system. By the beginning of World War II, most Federal agencies had developed separate cataloging systems thought to be best suited to their individual use.

Technological advances made during World War II flooded the various Federal supply systems with so many new items that the work of cataloging fell far behind that of procurement. As a result, identical articles were listed by separate branches of the same service under different numbers and descriptions and frequently under varying names. Out of the avalanche of demand for an adequate Federal supply catalog, facilities and appropriations for its development were ultimately provided.

The Federal catalog program is at present the joint responsibility of the Munitions Board Cataloging Agency, which represents military establishments, and the Federal Supply Service, which represents civilian agencies. Authority for co-ordination of the program has been delegated to the Munitions Board Cataloging Agency by the General Services Administration. The co-operative efforts of these agencies are expected to reduce the $3^1/_2$ million supply items estimated to be in our military supply systems and the $1^1/_2$ million supply items estimated to be in the supply systems of the Federal civilian agencies to approximately three million. In other words, the first goal in the cataloging program is to eliminate approximately two million duplicate items.

IMPORTANCE OF THE CATALOG

It is obvious that the intelligent use of a uniform catalog will preclude the purchase of thousands of unnecessary items, but that is only the start of the conservation of materials that can be realized. A decrease in the number of items purchased by the Federal Government means less demand on our industrial capacity and less stress on overworked transportation facilities. It means savings in storage space, with a consequent decrease in warehouse construction and less demand for scarce building materials. It means fewer people required to handle Federal supplies. It means tremendous savings in taxpayers' dollars. And since a uniform catalog system is designed to facilitate delivery of the right item in the right place, at the right time, it will save precious lives in time of war.

Under the impetus of the war in Korea, the then Secretary of Defense Louis Johnson called for greatly accelerated effort in cataloging items of military supply. In a memorandum addressed to the Secretaries of the Army, the Navy, and the Air Force, in September, he asked that within a year cataloging be completed in certain selected categories that contribute most

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JOINT RESPONSIBILITY *for* PRODUCTIVITY

By WALLACE CLARK[1]

PRODUCTIVITY is the joint responsibility of management and labor. This responsibility has changed as industry has expanded. At the beginning of this century the principles of division of labor and mass production were slowly penetrating one industry after another. Specialization of skilled workers had already made some progress. Before that time a machinist, for example, had done a great variety of things. He selected his material from the stock on hand. He decided how to make a part either without drawings or from incomplete sketches. He made, repaired, and sharpened his own tools, if he had any. He inspected or tested his own output and frequently delivered it to the shipping room.

As the principles of division of labor were applied to his work, the machinist was relieved of those jobs which did not require his specialized skills. Other men took care of stocks of materials, brought them to the machinist and, when he had finished his work, they took the parts away. Others were trained to inspect and test the product. Then the work which remained in the hands of the machinist became more specialized. In making a machine part he no longer took it from one machine tool to another, performing the various operations himself. Men with less experience were trained to operate machine tools, each one being assigned to one type of machine on which he could develop greater skill. Gradually the all-round machinist became either a foreman or toolmaker because those were the only jobs left in which he could make use of his full range of knowledge and experience.

Obviously, when a worker followed the product through all the operations in the shop, he carried on his shoulders most of the responsibility for the output. However, as his task was subdivided and assigned to a dozen men, no single workman was responsible for seeing the product through. The shop management took over the responsibility for training the dozen men and co-ordinating their work.

At first the foreman carried this responsibility. He did very well so long as his shop was small and he personally could supervise each worker and, at the same time, keep in close touch with other parts of the plant and the sales office so that he would know which jobs to do next. But industry expanded so rapidly that it became impossible for a foreman to supply all the information, instructions, and services needed by the workers. It became necessary to bring in men who through education and experience had become specialists and to assign to them the task of providing the technical knowledge needed by the foremen and workers.

In this period a change took place in American industrial organization, and for several years, extending through World War I, an argument raged between those who favored the continuance of simple line organization, which placed all responsibility on the foreman, and the advocates of full functional organization, in which staff departments issued instructions direct to the workers. The argument ended with a combination of line and staff authorities and this form of organization is now generally accepted in American industry.

In this organizational structure there is a straight line of authority to hire and fire and to tell a man what to do and what not to do. This usually extends, in a metalworking plant, for example, from the president down through the vice-president in charge of manufacture, the plant manager, superintendent, and foreman to the worker. On each level the executive has his staff of specialists in the functions for which he is responsible.

It is this type of organization which now carries responsibility for operating a manufacturing plant, having taken that task over from the foreman, who in turn had lifted it from the shoulders of the all-round workman in the small shop.

The personal responsibility of the worker for quality and quantity of production has narrowed down and the broader responsibilities have been taken over by the plant or company management. In fact, the majority of things which affect the productivity of labor are now under management's control: for example, materials and stores; production machines and equipment; technical instructions; quality control; and planning and scheduling.

The responsibilities for increasing output which are largely up to the worker are the development of his own skill, and the will to work, but even in these fields the initiation of improvements and the end results are in the hands of the management.

The level of technology in American industry has been rising for many years. Progress was accelerated during World War II by the increase in precision manufacture and the need for complete interchangeability of parts of war material. In metalworking plants this situation has caused the building up and strengthening of engineering divisions made up of men whose education and experience enable them to determine "the one best way" of doing the technical work of the company and to impart that knowledge to the workers.

MATERIALS AND STORES

The whole responsibility for the selection and use of materials is in the hands of the management. The engineers prepare accurate specifications for the purchase and inspection of the materials to be used in manufacture. The daily output of workers is largely dependent on the quality and workability of materials.

Obviously, the storeskeeping of raw materials, supplies, and parts has a direct and measurable effect on the daily production of the worker, who does not like to be idle while he waits for materials. It is not an easy task to have on hand all these materials and supplies when they are wanted for production, particularly in a period when there are so many shortages of steel and other items.

[1] Wallace Clark lived and worked in an era when the functions and responsibilities of the management of industrial enterprises were undergoing systematic and objective study and policies and practices relating thereto were being formulated. In his consulting practice in Europe and the United States he taught management and workers alike how to overcome "obstacles to the free flow of work"—mental as well as physical obstacles. The article here published is Wallace Clark's last address, and was delivered by him in March, 1948, before the Industrial Management Section of the Engineers Society of Western Pennsylvania, shortly before his death.—EDITOR.

PRODUCTION MACHINES AND EQUIPMENT

As everyone knows, we are in a period of unprecedented activity in the development of new and improved producing machines and equipment. Although these machines turn out better products and hold their tolerances more accurately than those they have replaced, nevertheless they become obsolescent more quickly due to advances in the equipment field. It is now economical to replace machines long before they are worn out.

In the last two or three decades industry made great progress in the application of electric power to work formerly done by hand. Equipment is still being invented to replace human energy, but the emphasis has shifted to improving power-driven machines so that they will do more and better work with less power and less time on the part of the operators. We used to be proud of an automatic machine that could do eight operations, but now we string six automatics in a line, each doing eight operations, without any handling by the operator.

This accelerated introduction of improved machines and processes has brought tremendous increases in workers' productivity made possible by management's technical brains and capital investment. To be sure, the worker has to learn how to operate these more complicated machines and to develop his skill in setting them up and keeping them producing up to quality standards.

Among all the ways of increasing production efficiency, the purchase of laborsaving equipment is probably the one that is best understood by factory executives. The rapid developments in this field have speeded up the obsolescence of machines. The company which has plenty of money available for capital investment and can replace its equipment in five years has a great advantage in cost of production over a competitor who changes his machines only after ten years' use.

Where quantities justify it, the extended use of tools is another well-understood method of increasing the productivity of workers. This also is largely in the hands of the management because it consists of design, toolmaking, and investment.

TECHNICAL INSTRUCTIONS

The improvement in technical processes and instructions has a marked influence on the output of the workers. The modern engineering division usually has a processing section which takes the design drawings and works out the most economical operations to turn out the product. Of course this section makes use of the information it has on materials and available machines and prepares its instructions either on drawings or in writing so that there is little chance of misunderstanding on the part of the operator.

This function of the engineering division is well understood by all manufacturing executives, and yet it is surprising to find drawings and records incomplete, inaccurate, and not up to date in many plants. Of course these conditions can be expected after years of war and readjustment when changes have been accelerated and there has been continued shortage of engineers. However, these instructions need to be revised in order to avoid waste of time and labor.

QUALITY CONTROL

One of the technics of management which has an immediate effect on productivity is quality control. It received great impetus during World War II, and since then many plants have gone over their entire range of management functions, from research to inspection, and have introduced means for improving quality and stimulating interest on the part of every one in the plant. This improvement and control of quality is a joint undertaking of the management and worker, but it must be initiated by the management.

PLANNING AND SCHEDULING

One of the most fertile fields for increasing productivity of the individual and of the entire labor force is by means of planning and scheduling. Over the years there has been much argument as to centralization versus decentralization of planning, but there is now a rather general agreement that it cannot be completely one or the other but rather it must be a combination in which each supplements the other. The shop or departmental planning can be considered the decentralized part, while the co-ordination of the plant as a whole is done in a central planning office.

In an organization of this type shop planning extends one or two days in advance. Its orders, received from the central planning office, tell the foreman, by means of beginning dates, the comparative importance of the work ahead of his shop. Each day the foreman, or rather his planning clerk, goes over the work in process and the orders due to begin and decides what orders should be started the following day. In assigning orders, he takes into consideration the machines which will be free for more work, those best adapted to do the order, and the workers who have the required skill.

In plants that are not on mass production, the sequence of orders is determined by the central planners who have available a considerable range of information as to dates of delivery, inventories, orders in process, routings specified by the engineering division, and the load of work ahead of workers and machines. A continuing study of these and other data enables the central planning office to reserve the time needed for each order on every machine that is to work on it.

The influence of planning and scheduling on the daily productivity of workers is very great, in fact, if it is not well done, it causes more irritation than any other function of management. The average workman likes to do a fair day's work and resents delays which he feels could be prevented.

He wants his own capabilities and those of his machine to be considered in the assignment of orders. The planning and assignment of work is the point where most of the varied functions of management are focused on the individual worker. The worker's productivity is invariably increased by good planning of his work.

THE WORKERS' SKILL

There are two areas, as I have said, where the worker carries the primary responsibility for productivity—in the development of his skill and his will to work. In these areas, however, the management also has important responsibilities.

The progress which a workman makes in improving his skill and knowledge of his job is largely within his own control. In practically all industrial sections of this country, a wide range of technical courses are available either without charge or for tuitions which are within the reach of the average workman. However, in plants where special skills are required, the company must provide the training needed. Under the pressure of war, as you recall, this "training within industry" accomplished results far beyond anyone's expectations. The management also needs to take a personal interest in what each worker is doing to improve his ability and, when this training brings increased output or better output, the company should reward him promptly by promotion or better earnings.

THE WILL TO WORK

The will to work is principally under the control of the worker, but it is greatly influenced by the management. Most companies provide good working conditions: plenty of light without glare; temperatures and ventilation which make a

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DEMOCRACY?—*What For?*

By P. W. NORDT, JR.[1]

PLANT MANAGER, JOHN C. NORDT COMPANY, INC., NEWARK, N. J. MEMBER ASME

A STORY was told by the late Roy V. Wright when he lectured before many groups on the subject of responsible citizenship—a story that illustrates, possibly in an apocryphal manner, the state of irresponsibility of many citizens in this land.

A small group of persons in a fair-size municipality became highly disturbed over the complete lack of interest shown by most citizens in the politics of their town. It was obvious that something drastic was required to jar the townsfolk out of their stupor. One of the group hit upon a plan. A friend of his owned a mule named Jack. With the friend's permission, the mule's name was placed upon petitions to enable it to run for town council. A suitable surname was selected so that, after the proper number of signatures was obtained on the petitions, the name of John Ash appeared on the ballot on Election Day. Possibly because of the appeal in a name, John Ash, the mule, was elected! So little did folks try to learn who were the candidates that any Jack Ash could have been elected.

For more than fifteen years the ASME has urged its members to exercise responsible citizenship. Probably Dr. Wright did more than any other individual to make this a policy of the Society and to implement this policy among the members. Those who knew him well were aware of the numerous times he could have become discouraged with the dearth of enthusiasm with which his ideas were received. There is no doubt that the pace at which he drove himself in order to awaken engineers to their civic responsibilities materially shortened his life.

ENGINEERS AND CIVIC RESPONSIBILITY

As people go, engineers are not unique in their failure to exercise civic responsibility. The fact is that no particular groups of people are more lax than others in this regard. The tragedy is that so many among all types of people take an apathetic view of civic affairs. Nevertheless, engineers would make a serious error to assume that, because they are no worse than others, they need not be concerned with this particular shortcoming. With practically all of us, participation in community and civic activities is beyond the normal routine of life. We have our jobs at which we earn our living. We have many family responsibilities that require our attention. We are careful to apportion regular amounts of time to recreation. So we hear the explanation that we have not the time to devote to civic affairs. It simply does not seem to fit into our daily schedule.

It has frequently been stated that for two important reasons engineers must sense a disproportionately high degree of civic consciousness. First, because the complexity of life today stems largely from the mechanical era for which the engineer must feel a major share of responsibility. Secondly, because of his training and professional environment, an engineer is accustomed to making decisions based on reason rather than on emotion or guesswork. He is eminently conditioned mentally to expect certain predetermined results, given a set of conditions. In chemistry he knows what to expect if certain materials are mixed in a specified way. An aeronautical engineer can predict with confidence the flight characteristics of an airplane as a result of computations and plans for its design and construction. This reasoned thinking is an attribute which singularly qualifies him for public service. In complete candor, however, engineers must be cautioned against assuming that problems involving people can be solved just as exactly and as easily as the technical problems of their professional world.

Neglect on the part of engineers, as well as others, to assume the obligations of citizenship probably stems from their failure to see clearly the answer to a very simple question. Why must a vast majority of the citizens take part in civic affairs in order to make a democracy succeed? Failure to learn the answer to this question is perhaps the greatest single danger to freedom. Most of us are so constituted that if we see clearly the reasons for a certain course of action, we will not hesitate to follow that course. If our house catches on fire, we know exactly what to do about it; if we fail to apply ourselves to our occupation or profession, we know the result; if we drive a car with an empty crankcase, we are aware of the consequences. *Why, then, in the field of human affairs do we fail to comprehend that certain laws of behavior are just as certain as the laws of physics and chemistry with which we are so familiar?*

DEMOCRACY AND THE INDIVIDUAL

A democratic nation is the result of the beliefs of people, the acts of people, and the struggles of people, starting years, even centuries, before democracy becomes a fact. Likewise, the fall of a democracy is the result of the behavior of people. No society remains unchanged regardless of the character of its members. These statements are accepted as true by almost everyone, but so often each individual fails to see himself as a positive part of the society in which he lives. He overlooks the fact that his action or inaction is helping to decide its future growth or decline. Citizens of a democracy are inescapably voting virtually from day to day on the future of their society. The little failures on the part of each one to assume responsibility when the occasions arise are votes against the freedom of all. When the votes of apathy, stupidity, and immorality gain a majority, democracy fails. The certainty of this is as sure as any physical laws that engineers recognize.

Man for centuries, indeed for hundreds of centuries, has continually sought freedom and security. The records of history, including the Biblical records, show this continuing struggle. Men have sought after some supreme leader in whom they could place great trust, through whom they could attain peace and security. The Old Testament brought forth the idea of one God, a being superior to man, in whom men could place their trust. As the ages passed, certain leaders arose who spoke for this God. The people followed them and achieved at least part of the goal that they sought. But as time went on, in each case, the leader forgot the God for whom he had first spoken and the people were lulled into a feeling of false security based on the power of one man. The results were chaotic and fraught with human misery.

There was a trend in recent times toward the belief that man alone, apart from any allegiance to a Supreme Being, could control his own destiny. This probably stemmed from the seeming conflict between science and religion. However, as our industrial civilization progresses, we are coming to the

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realization that something is lacking in our scheme of things. It is becoming increasingly apparent that despite the advantages that science and engineering seem to offer, we do not approach the "good life" quite as we may have hoped. Nevertheless, some few decades ago it seemed that most civilized men had learned one very important lesson, namely, that it was very risky business to allow one or a few people to gain power over many. During the early part of the twentieth century one would have confidently predicted that democracy was the "wave of the future."

THE SURGE TOWARD FREEDOM

The United States of America at its birth set in motion the greatest development toward freedom that man had ever experienced. The system of government ratified at that time made possible the greatest degree of individual freedom yet known to citizens of a large nation. This idea of freedom, being dreamed of and sought after for so many centuries, was highly cherished by those who had gained it. The sufferings under tyranny were so recently passed that it was natural for freedom to be recognized as something to guard and protect continuously. No citizens of that time felt that the new rights they had acquired would be perpetually guaranteed and protected by anyone but themselves. The government they had approved was not looked upon as a shield and protector against evil-doing or hardship. It existed by the people's consent, and powers delegated to individuals were carefully controlled. The authority that one man might have over another was limited that it might not exceed that required for the job the citizens desired him to do. The government must abide by a set of rules established by the people—the Federal Constitution and Bill of Rights. It must be remembered that the people were not satisfied with the new Constitution until the first ten amendments were appended.

The emphasis was on safeguards. People then were fully aware of the dangers of power—one man over another. Ages of history had taught them to treat with suspicion those who promised to bring the good life here on earth to those who would follow blindly and do as they were told. The need for a strong government in a land so vast as the United States was quite obvious. But the stronger the government, the greater the need for safeguards against encroachments.

"But," one might say, "who are these evildoers who await the opportunity to do us injustice?" We need not look beyond ourselves to find the weaknesses in human nature that make possible the abuse of power. In every one of us there is a degree of evil. If we are capable of honest self-analysis, we will admit that we behave ourselves largely because of the known penalties for misbehavior. What sins we might all commit if we knew we would not be caught! We also must confess that each of us has, not only the capacity for evil, but also varying degrees of stupidity. Were it not for the penalties in material wealth, prestige, and personal security, we would commit far more "boners" than we do. Persons in public positions are just as prone to evil and error as the rest of us; and the citizens exert the only basic control over their acts.

Democracy and government under law essentially compose a system for protecting each of us from his fellow men. There is some degree of evil in each of us. If we were all angels, governments would not be necessary. Since few, if any, angels exist among us, we must choose between the rule of despots and government by the people's law. All who do not participate in the government and laws which rule them fall prey to the evil that is in their rulers. Rulers, being mere men, can never be angels. Whether nonparticipation is due to willful neglect or forced restraint makes no difference, the result is the same—slavery.

DEMOCRACY DEGENERATES THROUGH FAILURE OF THE INDIVIDUAL

The degeneration of a democracy is slow and not immediately perceptible. In fact, the degree to which any particular citizen is responsible for this decline is hardly measurable. But the cumulative effect of millions failing their duty is the direct cause of an inexorable decline. A disquieting trend such as this can be stemmed only by the determined efforts of individuals, one by one. If each of us waits for the other to make the effort, or if each of us decides that for special personal reasons we are somehow excused from making the effort, there will be no slackening of our drift away from liberty under law.

The greatest danger threatening our way of life does not come from those who are energetically working to change our political or economic systems. The real danger comes from those citizens who, for any number of invalid reasons, sense no responsibility to their community, state, or nation. In an atmosphere where only a minority shows active interest in public affairs, the influence of special-interest groups grows large. Their political power becomes great, far beyond their proportion of the total population. Consequently those who have "axes to grind," pet projects, and dreamy schemes, gain a voice in government great enough to force their doctrines into law. We need never become alarmed by radical movements, whether colored to the Left or to the Right, provided a preponderant majority of the citizens sense their civic responsibility, educate themselves in the problems involved, and perform such duties as their consciences dictate. An apathetic citizenry provides fertile ground for both political corruption and governmental incompetence. Full comprehension by each of us that "eternal vigilance is the price of liberty" will defeat more subversive movements than all the laws our government could enact.

THE CITIZEN'S DUTY

There is no easy effortless way to discharge this responsibility. Indeed we cannot even do it by paying someone to do it for us. Certainly it is not done, as some think, by the simple process of keeping ourselves informed on public questions, as desirable as that may be. If the knowledge we acquire and the opinions we form are not put to use, of what value are they? To express our opinions only when we are among those who already agree with us contributes nothing to our own understanding and adds nothing to that of our listeners. Is it not a common habit of most of us to readily air our thoughts on politics and government especially when we are among like-minded people? At such times we frequently speak of those in public position in disparaging tones. When this practice becomes a habit, whom are we really criticizing? Let us reread the Constitution, then decide who is to blame if the wrong men are in office.

"But," we may say, "I didn't vote for them." Having voted with the minority does not relieve us from responsibility for those who gained office. Did we go out of our way to encourage those who feel as we do to cast their votes? Did we earnestly endeavor to discuss issues with those who disagree with us that they might learn our point of view and possibly change their minds? Only by a serious interchange of thoughts between divergently minded people will sound policies eventually prevail. We also hear the statement that none of the candidates, regardless of party, is worthy of our support. The reaction of so many who feel thus is to throw up their hands in disgust and conclude that it is useless either to affiliate with a political party or to vote. We reason that politics is a filthy business and the less we have to do with it the better. Such an attitude totally disregards the unavoidable truth that each of us plays an inescapable part within the

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Standardized BOILER UNITS

By CARL E. MILLER

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STANDARDIZATION has been the goal of all industry for many years. In the manufacture of boilers, much progress has been made in this direction during the past 10 years. This was due, in part, to the necessity of increasing production during the past emergency, but probably more to an increasing realization by the consumer of the benefits of standardization, namely, lower capital investment, quicker delivery, and simplified engineering. Improved engineering of the standardized boiler has not only brought a reduction in initial cost, but equally important advantages such as savings in operation because of improved efficiency, the ability to burn cheaper fuels, reduced maintenance, and greater reliability.

To discuss the subject of standardized boiler units at this time is particularly pertinent for two reasons: (1) it is an opportunity to show the present state of the art and evaluate it in the light of present requirements to engineering in general; and (2) it is a subject of keen interest to industry because of the pressing need for replacing many old and obsolete plants in the near future.

The situation on replacement plants was brought out clearly by recent studies which indicate the need for replacing more than 150,000,000 lb of existing steam-generating capacity. These studies have been based on a 30-year cycle of power-plant life which is reasonable. The report also indicates that power-plant obsolescence in certain areas already has reached the staggering proportion of from 40 to 75 per cent. As a rule, accrued savings from replacing such obsolete boiler and fuel-burning equipment will pay for a modern installation in from 2 to 5 years.

Usually a standard boiler is considered as one which has been completely designed in reasonable-sized increments to take care of various space conditions and the various fuels and methods of firing. Essential information such as boiler size, fuel-burning equipment, fuel flexibility, and performance are all tabulated information. Drums, tubes, headers, arrangement of heat-absorbing surface, soot blowers, and casings have all been worked out and completely detailed. Blueprints are available which are sent to the customer and shop immediately on receipt of an order. Many of the standard parts are already in a regular shop schedule so that maximum advantage is taken of the most efficient methods of production. An adequate stock is maintained of other essential items so that delivery can be expedited.

If a change is made in the size of the drum, or the size or spacing of the tubes, or the size and shape of the furnace, it is no longer a standard boiler. To build such a unit a designer must work out the details and a draftsman must make new drawings before the work can be released to the shop for special fabrication. This costs time and money. On the other hand, minor changes can often be made on a standardized boiler in order to suit the requirements of a particular application, as long as such changes do not involve the basic structure.

Most standard designs are built in the smaller capacities and for low pressure and moderate superheat, and the following generalities are approximately correct. The standard boilers, i.e., those requiring negligible engineering time, are available in capacities up to about 60,000 lb of steam per hr. These are generally for operating pressures in the range of from 100 to 400 psi. Usually, they are built to supply saturated steam only, but standard superheaters to give nominal superheat are available in a number of designs. Various types of stokers are used depending on the capacity of the unit. Oil and gas firing is used for all sizes. Below 30,000 lb of steam per hr, the single-retort underfeed stoker is common. Above that capacity, either the spreader stoker or traveling grate is usual. Pulverized fuel is not used because of the difficulties in economically attaining adequate flame travel and sufficient cooling of the flue gas to avoid slag deposits in boilers of this low capacity range.

At the present time, above 60,000 lb per hr, standardized types of boilers are generally available. In these, most parts are completely standardized to reduce engineering costs and time. Other parts are individually designed to fit the particular requirements of the installation under consideration.

BASIC DESIGN PRINCIPLES

To have a better understanding of some of the basic design principles of standardized boilers, let us review the more important ones briefly.

Support. It is usual practice to bottom-support all standard boilers in the smaller sizes. This has definite advantages. It obviates the necessity for outside supporting steel and for slip-joints and air seals which are not only expensive, but must be fabricated carefully if they are to be fully effective in reducing air leakage to acceptable limits. This is particularly important with stoker-fired boilers.

Furnace. Even in the smallest of standardized boilers, the use of water-cooled wall construction has been found to be an economically sound investment. Such construction eliminates the necessity for an independent brick setting which is costly to erect and maintain. It provides highly efficient heat-absorbing surface which reduces the amount of convection surface required in the boiler proper. Most important, it contributes to lowering the temperature of the furnace gas entering the convection bank so that slagging troubles are avoided even with coals having low ash-softening temperatures.

Because of the definite possibility of changes in the fuel market, it is always desirable that a boiler be so designed that it will not be limited to any one type of fuel. However, from the standpoint of initial investment, it is well recognized that a furnace designed exclusively for gas and oil can be much smaller than one designed for coal, and as a result is less costly. Hence some manufacturers are building two types of standardized boiler units—one with a universal type of furnace which is completely flexible and capable of burning any type of fuel, and a second unit with a smaller furnace that can be used with gas and oil only, and sold at a somewhat lower price.

Circulation. In its simplest form, boiler circulation consists of a three-part cycle: (1) Flow of water to heated areas; (2) flow of steam and heated water to release area; and (3) release of steam.

In fire-tube boilers which are the most common standardized

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units, circulation and steam formation take place within a single large mass of water. Because of the size of the shell and low heat-transfer rate per tube, circulation in this type of boiler introduces few problems.

In the more common types of water-tube boilers, certain complications arise and require particular attention. The addition of waterwalls and the necessity of reducing the number of drums and headers to keep costs at a minimum, tend to make the circuits more complex; and the number of individual paths for steam-water flow varies from point to point. This has given rise to many variations in tube arrangement to assure proper circulation.

Fig. 1 illustrates the simple circulatory system employed in

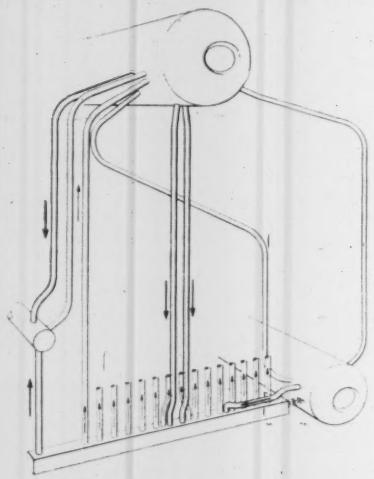

FIG 1 CIRCULATORY SYSTEM OF STANDARD WATER-TUBE BOILER

one of the widely used types of standard water-tube boilers. The rear tubes of the convection bank serve as feeders for the lower drum. The completion of the circuit back to the upper drum is by one of three ways: (1) Up the front tubes of the boiler bank; (2) to the side-wall headers and up the furnace side-wall tubes; (3) to the side-wall header, thence to the front-wall header, and then up the furnace front-wall tubes. As an added assurance, the feed from the lower drum to the wall headers is supplemented by connections taken directly from the water space in the upper drum. The positive flow of water from the upper to the lower drum is insured by locating a baffle so as to protect the last row of boiler tubes from the hot gas in the first pass of the boiler. Through this means positive circulation, essential to successful boiler operation, is assured.

The third part of the circulating cycle is to provide adequately for separating steam. To accomplish this, first in importance is to design the boiler system so that steam is generated uniformly across the entire width of the boiler so that no one part of the drum is overloaded. Second, auxiliary equipment should be provided in the drum to (1) partially isolate the incoming feedwater, and use this cooler water to supply the downcomers to the lower drum and thus also improve natural circulation; and (2) separate the steam from the steam-water mixture in a positive manner to avoid carry-over.

If such basic principles of circulation are applied properly to a natural-circulation boiler, fluctuating loads can be carried without carry-over or excessive fluctuations in water level. It is recognized, of course, that the concentration of solids in water is also a factor.

In recent years, much of the advanced thinking in boiler design, for both large and small units, has been directed toward a more widespread application of forced circulation. This method has the advantage of giving greater flexibility in design. The water supply to a furnace wall, or generating-section circuit, can be exactly proportioned in accordance with predetermined requirements. This has made it possible to use smaller furnaces, higher rates of heat release, and smaller-diameter tubes with resulting greater heat absorption for a given size of boiler convection bank. These advantages are becoming increasingly important in applications where space and weight limitations are a major factor. For example, one application of this type of unit is a steam-generating unit for train heating on Diesel locomotives. Details of this unit will be discussed later.

Another factor to be considered in conjunction with circu lation is water treatment and boiler cleaning. At the present time, industry has generally recognized the advantages of proper boiler-water conditioning, even in the smallest sizes of boilers. As a result, problems associated with attaining reliable and continuous service, maintaining efficiency, and boiler cleaning are rapidly decreasing. At the same time, the trend has been away from mechanical cleaning of boilers using various turbining tools and similar devices, and toward the use of chemical cleaning to remove scale. Not only is chemical cleaning usually a faster and cheaper method, but also it is the only practical method of cleaning some of the types of modern boilers.

Convection Surface. From an economic standpoint, there is a limit to the efficiency which can be attained Considerable judgment must be used in choosing this point as it depends on many things, particularly fuel cost and load factor. In designing standardized boilers, a compromise decision has been made based on a study and analysis of large numbers of industrial installations. In some applications, economics may not justify an efficiency as high as that normally furnished on the standardized boiler. Even in such cases it is usually found that the higher efficiency of the standardized boiler can be purchased at a lower price than a special boiler designed with less heating surface. The user still has the additional advantage of a more efficient unit with its additional advantage of lower operating costs.

In other cases, higher fuel costs may justify higher efficiency than the standard boiler will deliver. Supplemental heat-recovery devices can then be added to the standard boiler to give the results desired.

Casing. A wide variety of casing construction is found in standardized boiler units. In water-tube boilers, the steel casing is most common. To simplify construction and erection, it is often supported entirely on the waterwall. This has the additional advantage of giving a panel-type construction that is simple, expands uniformly, and is easy to maintain. Thus air leakage is reduced to a minimum.

Fuel. While in most areas of the United States coal is still the basic fuel, in some areas use of oil and gas has been increasing very rapidly. This increase in usage has particularly affected the small industrial plant. It is probable that this trend will continue, but also that within a reasonably short time the increase in demand for steam and power, with our expanding industry, will be so great that coal consumption will also be on the upward trend. Because of this changing fuel situation, management is often specifying either dual firing or a design suitable for future application of coal-burning equipment with minimum changes, even though the unit is to burn oil or gas initially.

TYPICAL EXAMPLES

The application of the foregoing principles in the design of standardized boilers is interesting. Obviously, because of the great variety of applications, it is impossible to describe all of them. However, if three typical examples are selected, representative of widely diverse conditions, it will present a reasonably comprehensive picture of the field. To accomplish this, the following units have been chosen:

1 A compact oil or gas-fired forced-circulation boiler.
2 A two-drum standard water-tube boiler designed for moderate capacities and capable of being fired by all types of coal as well as oil and gas.
3 A two-drum water-tube boiler suitable for larger capacities and all types of firing.

Compact Oil or Gas-Fired Forced-Circulation Boiler. As a general rule, the smaller types of standardized boilers are shipped completely assembled with all auxiliaries applied. These units are the most truly standard. A special example of such a unit is the oil-fired forced-circulation unit originally designed to supply steam for car heating on Diesel-propelled trains and now becoming increasingly popular for special industrial applications where relatively small quantities of steam are required.

A 6000-lb per hr unit of this design requires an approximate floor area of only 5 ft × 7 ft, including the feedwater pump and control, oil pump and control, combustion and safety control, forced-draft fan, oil-heater safety valves, and all other accessory devices. Only four things are needed to place the unit in operation; a source of electrical power, water, fuel, and a connection to the steam line. It can generate up to 6000 lb of steam from a cold start in a few minutes. It is completely automatic with automatic push-button start-and-stop control, with a complete set of protective devices so that no regular operator is required.

The constant-speed centrifugal pump takes water at saturated-steam temperature from the bottom of the steam separator and

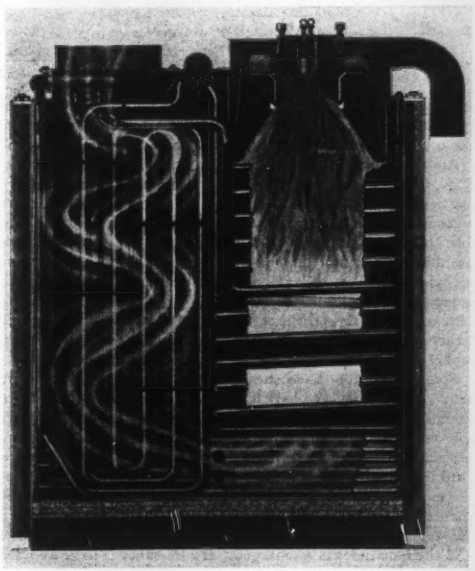

FIG. 2 FLAME AND GAS TRAVEL—FORCED-RECIRCULATION BOILER

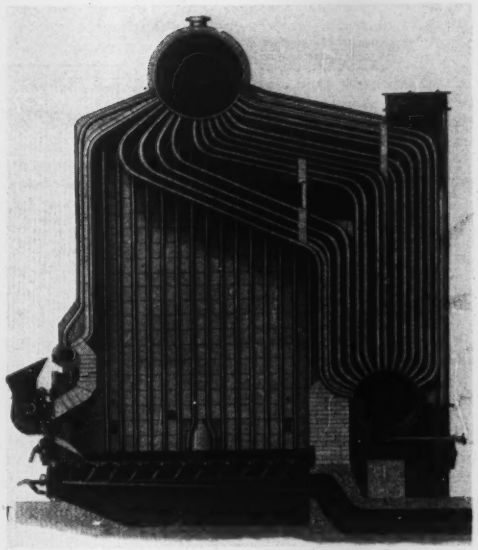

FIG. 3 TWO-DRUM STANDARDIZED WATER-TUBE BOILER

deaerator and discharges it into an inlet header. This header feeds a number of steam-generating elements which are varied in number according to the capacity of the generator. At the entrance of each element is a metering orifice, which has a pressure drop considerably higher than the pressure drop through the element. This insures a proper distribution of water through all elements.

Fig. 2 shows a section through this steam generator. To give maximum combustion flexibility, two burners are used. For starting, a small "all-on" or "all-off" burner is operated by a pressure limit switch. It is adequate for steam demands up to 700 lb per hr. Beyond that, a larger burner is cut in and operates up to the maximum rating of the boiler. The fuel to this larger burner is regulated by a valve operating in response to a steam-pressure-actuated bellows. As the steam pressure drops, the pressure of oil to the large burner is increased, and as the steam pressure increases, the pressure to the larger burner is decreased. As the oil pressure to the larger burner changes, it operates a damper regulator which regulates air flow to the burner. In this manner the proper amount of air is admitted to the burner to give satisfactory combustion at all loads.

In this unit, the rate of heat release per cubic foot of volume at full load is approximately 250,000 Btu per hr. However, the rate of heat absorption per square foot of wall surface is 55,000 to 60,000 Btu per hr, a very nominal figure, particularly with a forced-recirculation system. As long as adequate furnace cooling surface is available to absorb this heat without undue burden on any part of the furnace wall, operation is satisfactory with both liquid and gaseous fuels.

Fire-Tube Boilers. Fire-tube boilers of various designs are well known and their limitations for stationary practice on size and pressure are quite generally understood (approximately 12,000 lb of steam per hr maximum capacity, and 200 psi maximum operating pressure). Although the large proportion of these boilers in use are coal-fired, in recent years there has been a definite trend toward use of oil-fired units.

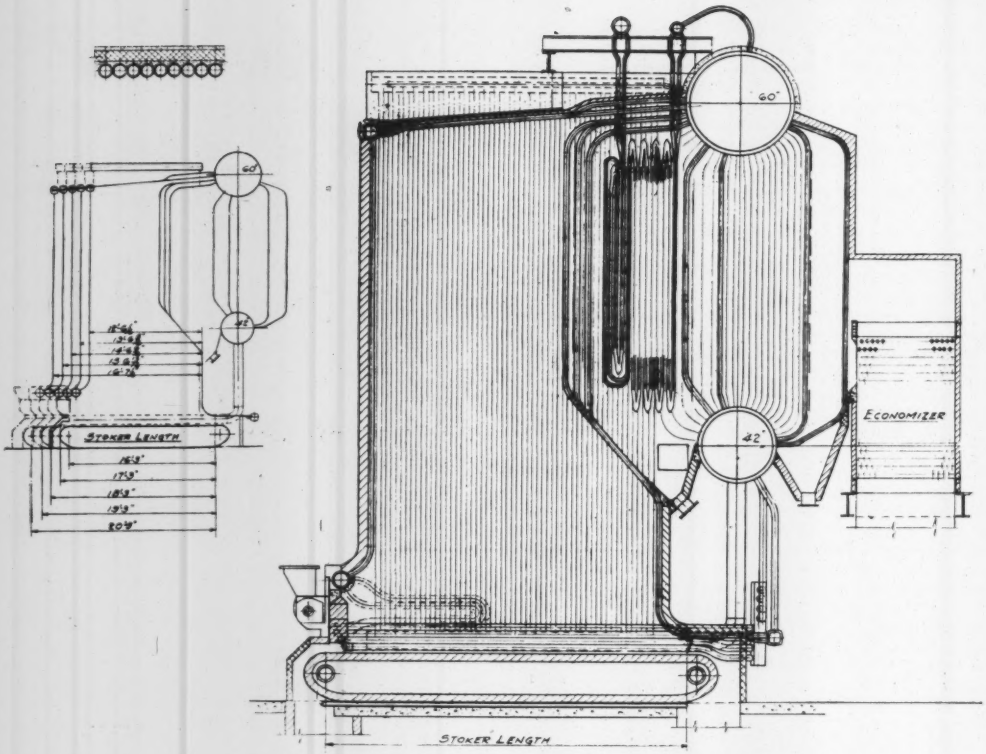

FIG. 4 TYPICAL STANDARDIZED WATER-TUBE BOILER FOR HIGHER CAPACITIES

Water-Tube Boilers—Intermediate Size. Several standardized sizes of water-tube boilers are available in the intermediate sizes of approximately 10,000 to 60,000 lb of steam per hr, and for pressures up to 500 psi and total steam temperatures of 750 F. They can be used for industrial process-steam requirements and also for the smaller sizes of power-generating plants. Fig. 3 illustrates an example of a two-drum steel-cased waterwall furnace standardized boiler widely used in this range of capacities.

In order that a unit of this type may have complete fuel flexibility, one of the most important considerations is to provide adequate furnace volume. This will result in conservative rates of heat release so that a broad range in the types of coal can be utilized successfully with minimum operating difficulties and smoke and cinder carry-over.

The combination of a fully water-cooled furnace, made up of tubes properly spaced in the front and side walls and boiler tubes forming the rear furnace closure, provides a substantial amount of highly efficient steam-generating surface. Waterwall construction also virtually eliminates refractory maintenance and permits high furnace temperatures without slag or objectional ash deposit. These high furnace temperatures assure rapid completion of the combustion process. In this case, the water-cooled furnace is simply and adequately enclosed in a casing made up of block insulation and steel paneling. The casing panels are carried by the walls and furnace tubes, an arrangement which minimizes expansion problems. This construction assures minimum loss from radiation and infiltration, and a cooler more comfortable boiler room in which to work.

Another important factor is to incorporate in the design all those features which will give the lowest first cost by simplifying field erection. Obviously, these units, because of their size, must be shipped knocked-down and erected in the field. Therefore the objective is to simplify this phase and reduce it to an absolute minimum. Typical examples of how this is done include (1) the use of waterwall construction which eliminates independent brickwork settings; (2) the use of a bottom support which obviates the necessity for an outside supporting steel structure; and (3) elimination of slip joints and air seals in stoker-fired boilers.

Spreader stokers have shown a consistent popularity in recent years. They are highly adaptable to burning the lower grades of coal, particularly the smaller sizes and those having a low ash-softening temperature. Their operating characteristics are such that they are not well adapted to very light load or banking conditions, but are ideal for carrying continuous, heavy, and fluctuating loads so common in many industrial plants. They have the disadvantage that fly ash is formed in substantial quantities. A part of this is caught in the boiler, and the remainder is discharged. If a nuisance is to be avoided, careful consideration should be given to the installation of an efficient dust collector.

The single-retort moving-grate type of underfeed stoker has proved to be a reliable and efficient machine for burning most coals, both caking and noncaking bituminous coal. This type of stoker is very flexible in its operating characteristics and is particularly well adapted to banking and light-load operations. Even bituminous coals with low ash-softening temperatures can be utilized if the stoker is conservatively rated for the load conditions to be encountered, so that clinker formation is avoided. Conservatism in design in the application of these stokers will also result in a minimum of fly-ash carry-over so that only in very exceptional cases will a fly-ash collector be required.

Another type of more simply designed single-retort side-dump underfeed stoker also can be applied to these standardized boilers in smaller capacities. This unit is basically the same as the heavy-duty machine, but its fan equipment is incorporated as part of the stoker drive mechanism.

In some areas, the chain-grate stoker is often the best over-all choice. This stoker has excellent flexibility and effectively utilizes anthracite as well as all kinds of free-burning bituminous and subbituminous coal and lignite. The fly-ash carry-over is relatively low so that, if the unit is conservatively designed, there is no necessity of installing cinder collectors except in exceptional cases. Another advantage of this type of stoker is that ash is discharged from the stoker in a form that is easy to handle and as it is collected in a single pit at the rear of the stoker, a simple conveyer mechanism is all that is needed for removal.

A fifth application is the use of oil or gas burners. With the furnace conservatively designed for burning all types of coal, there is no problem of applying oil or gas burners to a unit of this type.

In many of the eastern industrial areas there are economic as well as availability reasons for being able to burn coal as well as oil and gas in these standardized boiler units. This advantage has become increasingly important as natural-gas lines have been expanded into eastern industrial areas and fuel oil and coal prices have reached a more competitive level. The usual practice in accomplishing this in smaller units is to install the stoker in the front of the boiler as shown and then apply oil or gas burners as required in the side walls.

Water-Tube Boilers—Larger Sizes. For boiler capacities above 60,000 lb per hr, more flexibility is required in the furnace design to cover a broad range of capacities at minimum cost and at the same time apply all types of firing. Fig. 4 illustrates a unit designed to accomplish this objective. Although a continuous-ash-discharge spreader stoker is shown, other fuel-burning equipment, such as pulverized coal or gas and oil burners, is applicable. Standardization is attained by the use of a single-drum center for all capacities, a single setting height and the same length of wall tubes. To care for variations in capacity, the length and width of the furnace is varied in increments to suit the standard stoker.

CONCLUSION

Although this discussion has been limited to a few examples of standardized boiler units, it can be seen that tremendous strides have been made in raising the standards of performance in small industrial plants. The experience gained during the war has resulted in standard units of all sizes which can be furnished on practically an "off-the-shelf" basis. These units are flexible, well-engineered, easy to install, and efficient. They are built as one co-ordinated unit including all auxiliaries and combustion control, and, most important, they have correctly designed and properly proportioned fuel-burning equipment and furnaces. Most of them are completely flexible as to the type of fuel they can burn and are available in designs where changes can easily be made from one type of fuel to another.

The reduction in engineering costs from these standardized designs and package units, the quick return of design information to the purchaser to enable him to go ahead with foundations and piping connections, the speeding up of fabrication and delivery time have well demonstrated the soundness of the approach used in improving the design of modern small industrial plants.

Joint Responsibility for Productivity

(Continued from page 6)

person feel like working; facilities for relaxation, exercise, and amusement; good meals at low prices; and the many other things which cause a man or woman to say, "This is a good place to work." Standards of working conditions have been rising for years and will continue to improve.

Good wages and incentives have a direct and immediate influence on the will to work. Leading companies have introduced policies and practices which are generous, fair, and easy to understand. This country pioneered in high wages as one of the most effective means of getting work done at low costs, and the soundness of this policy is now generally accepted.

There is one more area which has a most immediate effect on the desire to do a good day's work, and that is in the worker's contacts with the management, from the supervisor up through the foreman to the higher executives. If there is a sudden change in productivity in either direction, one of the first causes to search for may well be in the worker's recent contacts with his foreman or supervisor.

Personnel executives usually realize the responsibility of management in this connection and some of them say that one of their primary objectives is to keep the workers in a frame of mind to do a good day's work.

DEMOCRATIC ORGANIZATION

Of all the things which the management can do to help its workers increase their productivity, the most effective is to build up around them a democratic organization in which each workman, supervisor, and executive has a field in which he can use his skill, knowledge, and creative ability. In such an organization, authorities are clearly delegated and each man is held responsible for the way he uses his authority and the results he secures; each one removes the obstacles to a free flow of work which are under his control and brings to the attention of others the delays for which they are responsible. On each level, workers or executives are given an opportunity to take part in policy making and developing programs of action. Channels of information are kept open and facts are reported without fear or favor. At the same time, each man accepts responsibility for co-ordinating his work with that of others.

Autocratic management does not dare to run its business in this way, nor does a totalitarian government. In this country we have gone far in extending democratic organization for our industries. That is one of the things which has caused our rapid development and which carried us successfully through the last war. With a democratic structure of organization, management and labor together can reach new levels of productivity.

Combination GAS TURBINE—STEAM TURBINE *Unit*

Performance of Installation Burning Natural Gas at Belle Isle Station

By J. W. BLAKE

ASSISTANT SUPERINTENDENT OF GENERATION, OKLAHOMA GAS AND ELECTRIC COMPANY, OKLAHOMA CITY, OKLA. MEMBER ASME

GENERAL

An unusually successful year of operation of a 3500-kw simple-cycle gas turbine in combination with a medium-pressure steam-turbine generating station has been completed. The engineering and construction features have been covered in a previous paper (1)[1] and by articles in the technical press (2); also, some of the operating results have been discussed in a paper (3), and in the technical press (4, 5). Now that a full year of operation has been attained, it is possible to present a broader view of what can be expected of American-made impulse-type gas turbines as used for utility service.

DETAILS OF THE STATION, ITS OPERATION AND FIRST COST

The Belle Isle (formerly Huey) Station of Oklahoma Gas and Electric Company, prior to 1949, consisted of three 200,000-lb per hr boilers and two turbines of combined capability of 56,000 kw. The boiler plant had a capability of only 51,000 kw, resulting in a deficiency of steam generation of 5000 kw. The cycle was 400 psi, 750 F, 2 in. back pressure. A natural-gas-burning simple-cycle gas turbine (6, 7) with an exhaust-heat recuperator for feedwater heating was installed in 1949. This unit added approximately 4000 kw of direct generation and 3000 kw pickup from steam turbines. This latter amount was made available by allowing the turbines to operate semi-straight condensing by using gas-turbine exhaust through the recuperator for feedwater heating. A compressor precooler, supplied with station deep-well water, has kept the capability of the unit up in hot weather.

The gas-turbine unit was put in commercial service on July 29, 1949, and data used herein cover a period through August 31, 1950. This represents an operating period of 13 months.

Some of the major points generally considered in looking into a prime mover for utility service are (*a*) first cost, (*b*) availability, and (*c*) operating costs.

The cost of the installation has been discussed in full in other papers (1, 3) and articles (2, 4). It was shown that in this particular application, the unit cost, based on capability obtained was slightly less than $100 per kw. This is certainly low enough to make this type of generation attractive.

AVAILABILITY

Availability of the unit is a feature which can be evaluated only by operating hours. An accounting of the total hours since the unit was placed in commercial service should be of interest. An itemization of this time shows the following:

Total installed hours	9564
Hours in service	7609
Hours scheduled out	1921
Hours forced out	34

It can be seen that for the full period the unit has shown an availability of 79.5 per cent. This is not too good for this class of equipment, hence a further breakdown is necessary to give the complete story.

Of the outages, the portion classed as "Scheduled" predominates and can be split into three categories: (*a*) inspections, no maintenance done, (*b*) initial inspection and overhaul, (*c*) maintenance. The actual hours for each of these subdivisions were as follows:

(*a*) Inspections, no maintenance	564
(*b*) Inspection and overhaul	1057
(*c*) Maintenance	300

Examining these three items, only the last one was actually necessary. The first two were precautionary in nature and probably could have been omitted without affecting the operation of the unit. If this had been done, an availability of 97.5 per cent would have resulted.

There have been two forced outages, both taking the unit off the line and shutting it down automatically. The first was the failure of the main gear-driven centrifugal lube-oil pump. A bad impeller casting was the cause, and no damage resulted, other than to the pump itself, since the motor-driven auxiliary lube pump cut in and protected all bearings and gears. The dip in oil pressure, however, caused the low-oil-pressure trip to shut the unit down. Down time was 30 hr.

The other forced outage was from failure of combustor flame detectors (thermopiles) which are of "fail-safe" type. They are installed on two combustors, and either one of the two will hold the unit in service. In the case at hand, both had burned open. Spares were on hand, since the life of these units has not been too good, and down time was only 4 hr.

OPERATING COSTS

After a unit has been placed in service, its operating costs are the standard of comparison. In keeping with current statistics, the operating items which will be considered are as follows:

(*a*) Fuel economy and costs.
(*b*) Maintenance costs.
(*c*) Operating labor and miscellaneous expense.

Fuel Economy and Costs. When a plant is being used for base-load service, the largest single item is fuel, hence a rather detailed analysis has been made of that item as respects the use of gas turbine and steam turbine in combination through feedwater heating.

[1] Numbers in parentheses refer to the Bibliography at the end of the paper.

Contributed by the Gas Turbine Power Division and presented at the Annual Meeting, New York, N. Y., November 26–December 1, 1950, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Manuscript received at ASME Headquarters October 2, 1950.

The operation of the gas turbine-steam turbine combination has shown a reduction in heat rate of the base station. Studies had shown that such application could be made using a simple-cycle gas turbine for initial steam-station conditions as high as 850 psi 900 F without hurting station economy. As initial conditions are lowered, the station improvement is greater. These studies have been confirmed for the 400 psi 750 F region.

The recovery of exhaust heat places a simple-cycle unit in an entirely different bracket since, without recovery, the unit itself will perform at a heat rate about equal to a steam station having initial conditions of 200 psi 500 F.

The type of gas turbine used in this application is basically a full-load unit. The best economy is at full load, with reduced loads causing economy to become progressively poorer down to no load where fuel consumption is approximately 50 per cent of that at full load. It is apparent that such an application should best be made in a system large enough to allow the unit to be kept at full load while in service.

Sufficient operating data have been taken to allow a rather complete analysis of fuel economy over the full operating period. Commercial service for the full 7609 hr provides the data given in Table 1.

TABLE 1 PERFORMANCE DATA

Period covered: July 29, 1949, to August 31, 1950
Total operating hours, 7609
Equipment rating—1, 30,000-kw steam turbine
1, 20,000-kw steam turbine
1, 3,500-kw gas turbine

Average load on station, kw	40557
Average load on gas turbine, kw	4118
Unit capacity factor, station, per cent	85.1
Unit capacity factor, gas turbine, per cent	119.2
Average load pickup through gas-turbine exhaust, kw	2400
Average load credited to the gas-turbine fuel, kw	6518
Average fuel to gas turbine (natural gas) in million Btu/hr	84.4
Average heat pickup from gas-turbine exhaust to feed-water, million Btu/hr	39.2
Average heat rate from gas-turbine exhaust recovery, Btu/kwhr (HHV)	16380
Corresponding thermal efficiency (HHV)	20.2
Average heat rate from gas-turbine fuel, Btu/kwhr (HHV)	13200
Corresponding thermal efficiency, (HHV)	25.8
Average heat rate regenerative feed-heating portion of station, Btu/kwhr (HHV)	15579
Corresponding thermal efficiency (HHV)	21.9
Average heat rate, total station, Btu/kwhr (HHV)	15229
Corresponding thermal efficiency (HHV)	22.41
Gas turbine:	
Average compressor air-inlet temperature, deg F	62.5
Average turbine-inlet temperature, deg F	1340
Average exhaust temperature, deg F	795
Max load (56 deg F compressor inlet-air temperature) kw	5000
Gross generation, gas-turbine generator, kwhr	31,320,000
Gross generation, gas turbine-steam turbine combination	49,600,000
Steam turbines:	
Average steam pressure, psig	402
Average steam temperature, deg F	728
Average condenser, back pressure, in. Hg	2.06
Unit fuel cost, gas turbine - steam turbine combination, mills per kwhr	1.170
Unit fuel cost, total station output, mills per kwhr	1.369

In the region at which the unit has operated, 4000 to 5000 kw, the increment is approximately 11,000 Btu per kw (HHV).

The heat rate of recuperator recovery heat has been found to be approximately 5 per cent greater than that of the steam units operating on the original regenerative feed-heating cycle.

Maintenance Costs. Little maintenance has been necessary on the unit and all work has been done by regular plant forces. As is standard company practice for new steam turbines, an overhaul and inspection was scheduled to be done after about 6 months of operation. For this work a manufacturer's engineer was secured as a supervisor. The entire turbine-compressor unit was dismantled and closely inspected. Zyglo and Magniglow were used on important parts such as nozzles, buckets, compressor blades, and the like. Balance of rotors was checked in dynamic-balancing equipment, and original factory balance was found to be unchanged. In the future it is planned to put the unit on the same 3-year basis as is used for the steam-turbine units. It is likely that the present schedule of 6 months for minor inspection, requiring 3 to 6 days, may be continued. Combustors are on a 1000-hr inspection basis and, since such inspection requires only a 4-hr outage, this schedule probably will be maintained.

The total maintenance costs for both material and labor to date have been $9682. This includes, of course, all components of the entire installation. Of this amount, the routine month-to-month costs were at an average monthly rate of only $128. No maintenance has been necessary on the exhaust-heat recuperator.

The overhaul and inspection referred to was more extensive than normally will be made in the future. It was felt justified owing to the newness of the design, together with lack of experience in operation. A total time of 44 days was taken and the expense was $7017. Little material was found necessary, the majority of the expense being labor. It is estimated that subsequent inspections can be made in about a 14-day period and at a cost of around $3000 to $4500, depending on materials required. Being done on a 3-year basis, this would be at a rate of $1000 or $1500 per year.

Since the maintenance costs under discussion cover the combined gas turbine - steam turbine output, it is necessary to charge it with a portion of the steam-plant maintenance. The equipment considered for apportioning against the gas-turbine unit should be the entire station with the exception of the boiler plant. Further, this should apply only to the fraction of the combination output which is derived from exhaust-heat recovery. A study of this item shows that approximately $^2/_3$ of plant maintenance should be charged on a kwhr-ratio basis against the steam-turbine pickup. For the period under discussion, this was $2300.

From the foregoing analysis, the total maintenance costs for the installation have been as follows:

Gas turbine and accessories	$ 9682
Portion of steam-plant maintenance	2300
Total	$11982

It can be concluded from the discussion and figures that the over-all maintenance for a gas turbine-steam turbine combination should be approximately $1 per kw per year, based on the average capability of the combination.

OPERATING LABOR AND MISCELLANEOUS COSTS

A full complement of dependable supervisory equipment, together with semiautomatic controls make the unit almost self-operating. It reasonably follows that there has been no need for additional operating labor in the station since the gas turbine unit was placed in service. It is believed that this would still be the case if more than one unit were installed.

Miscellaneous expense includes such items as lubricating oil, cooling water, station supplies, supervision, etc. Of these items only one has been separated accurately, and that is the lubricating oil. Records show that a total make-up of 260 gal has been required. This includes some small but persistent oil leaks which were not corrected until the overhaul, as well as

the oil which was inadvertently lost in transferring in and out of tankage during the overhaul. The present rate of make-up is about 12 gal per month. With the oil which is being used costing $0.75 per gal, total costs have been only $196. Currently, the lube-oil item will run about $108 per year.

In arriving at a total of this entire account, an estimate rather than actual records must be used. Based on the complete station accounts and apportioning it to the gas turbine-steam turbine combination output, would show a cost of $16,800. It is believed a factor of 0.5 should be applied to arrive at a reasonable cost. This account would then be $8400.

Summary of Production Costs. A total of all items making up production costs shows the following:

Fuel	$58000
Maintenance	11982
Operating labor and miscellaneous expense	8400
Total	$78382

This expenditure resulted in a generation of 49,600,000 kwhr, hence the unit cost was 1.580 mills per kwhr. This compares with a unit cost for the complete station of 1.886 mills per kwhr.

CONCLUSION

For an application of a thoroughly new form of prime mover, it is believed that the first year's performance as shown in this paper has been remarkable. Further, the use of a gas turbine with steam turbines operating in a 400-psi 750 F range combined through feedwater heating has shown that such a method improves station economy along with making available to the station a capability equal to 185 per cent of the gas-turbine rating. The station-economy improvement is on the order of 2¼ per cent reduction in heat rate, and a thermal efficiency improvement of ½ per cent.

The total production costs for operating such an installation are 20 per cent less than those for the total station. It is indicated that the maintenance on such an installation should not exceed $1 per kw per year of combination capability. This is believed conservative since the critical parts of the gas turbine, such as gas tips, combustors, nozzles, and buckets are still in excellent condition.

The performance of this unit in utility service definitely shows that a new type of prime mover is here. It compares favorably with other types in all respects. We can all be grateful to a manufacturer whose technical and engineering talent, together with design ingenuity, has advanced a much publicized machine to an actual installation.

ACKNOWLEDGMENT

The Belle Isle Station operating staff, headed by Mr. G. D. Conley, chief engineer; R. W. Baze, assistant chief engineer; and J. D. Graham, results engineer, through their earnest cooperation and interest, has had a major part in the successful operating record of the installation. Mr. A. A. Hafer, turbine field engineer, General Electric Company, has been of much assistance in following the performance of the gas-turbine unit.

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6 "Design Features of a 4800-Hp Locomotive Gas-Turbine Power Plant," by Alan Howard, MECHANICAL ENGINEERING, vol. 70, 1948, pp. 301–306.

7 "Test of a 4800-Hp Locomotive Gas-Turbine Power Plant," by Alan Howard and B. O. Buckland, ASME Paper No. 48—A-98.

The Role of Conservation in Mobilization Planning

(Continued from page 4)

significantly to national defense under conditions of either total mobilization or partial mobilization. It is estimated that from 75 to 80 per cent of the items in military supply fall within these categories.

In this work the conservation specialists of the National Security Resources Board have played an important part. Largely through our efforts technical and trade-association executives are being called upon for assistance and advice, with the result that the catalog when completed will reflect to a large degree industrial practices. When you who are active in the industries that are still to be covered are requested to participate in this important undertaking, I trust you will recognize the obligation and the opportunity, and give freely of your time and experience.

THE FIELD OF CO-ORDINATION

Perhaps the most important activity that will be undertaken by the National Security Resources Board in the field of conservation will be the re-creation of a Conservation Co-Ordinating Committee which proved so helpful in World War II. In September, 1942, Donald Nelson asked the Undersecretaries of the Army and Navy and the chairman of the Maritime Commission to appoint representatives to meet with the director of the then Conservation Bureau of the War Production Board to discuss ways and means of co-operating in an all-out drive for Conservation. Later this small group was expanded to include Lend-Lease, Treasury Procurement, the Aircraft Co-ordinating Committee, and the Board of Economic Warfare, and was given the name of the Conservation Co-ordinating Committee. The deliberations of this committee which resulted in broad unified programs of conservation were carried out with great success and with complete understanding and co-operation. Several weeks ago, Chairman Symington agreed that a similar committee should be set up under the chairmanship of the NSRB to include representation of all three divisions of the Department of Defense, the Munitions Board, the National Production Authority, and other Government departments and agencies that have a major concern with materials, facilities, man power, and production. I have been spending my time for these several weeks visiting the heads of these departments and agencies so that the purposes and programs of the Conservation Co-ordinating Committee should be understood and the appropriate representatives selected when the invitations from Mr. Symington are received. Nineteen departments and agencies will be represented. I am happy to say that the plan has met with enthusiastic approval.

In this somewhat disjointed outline I hope I have given you a preview of a united effort to make the most we can out of the materials, facilities, and man power that are available to our nation. The results should be fully as helpful in peace as in war.

BRIEFING THE RECORD

Abstracts and Comments Based on Current Periodicals and Events

COMPILED AND EDITED BY J. J. JAKLITSCH, JR.

MATERIAL for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context and credit to original sources is given.

Atomic-Powered Submarine

AN atomic-powered submarine, of which the first would cost an estimated $40,000,000, or about four times that of present fleet-type submarines, might be capable of extending greatly the operational range while completely submerged, and at speeds greater than of surface operation, K. A. Kesselring said in New York, N. Y., before a recent meeting of the Nuclear Energy Division of the ASME Metropolitan Section.

Mr. Kesselring is assistant head of the engineering division of the Knolls Atomic Power Laboratory, which the General Electric Company operates at Schenectady, N. Y., for the Atomic Energy Commission. The laboratory is now devoting its major effort to the designing and, later, the construction, of a shipboard atomic-power plant for the U. S. Navy. One application of this plant is expected to be in submarines.

He said that even though the snorkel breathing tube, introduced in World War II, now makes it possible for submarines to remain submerged for far longer periods than formerly, they are still tied to the surface since their Diesel engines must be supplied with air. The atomic submarine, however, could cruise completely submerged, for periods limited only by the air requirements of the crew, stated Mr. Kesselring.

It could be designed for underwater cruising as the normal operation, he pointed out. Thus the hull design could be altered to improve its hydraulic characteristics so that, for the same amount of power delivered to the propeller shafts, its submerged speed would be even greater than what it could do at the surface.

In addition, he added, full-speed underwater operation would be possible for extended periods reckoned in days rather than in minutes. And since the submerged speed could be enough to bring all surface vessels within its range, the submarine could go after its prey, not, as in the past, wait for its victim to approach.

Instead of increasing the amount of machinery, he said, atomic power might actually reduce the weight of the craft's power plant. The dead weight of atomic fuel for an extended cruise would be negligible. Even the heavy shielding needed around the atomic reactor, for protection of the crew, might be less than the heavy fuel tanks and batteries in conventional submarines.

Another factor, he continued, is that the ratio of time on patrol to time in the water becomes so high that the number of submarines required becomes appreciably less. This is extremely important in view of our submarine fleet of 170, compared with the Russian of at least 350, and the average construction time of close to two years per fleet-type submarine.

Mr. Kesselring revealed that the submarine would use an atomic reactor, operating at high temperatures, to produce heat. The heat, in turn, will be transferred from the fuel to a liquid metal in a closed low-pressure system, and thence to a boiler where steam will be generated to drive steam turbines of standard type.

The power delivered to the shafts will be greater than that now provided for fleet-type units. There will be no tangible products of combustion released, and safety of personnel will be carefully maintained through the use of radiation shielding.

Antisubmarine vessels would find it difficult to locate an atomic submarine, Mr. Kesselring pointed out. They would have to use full speed in order to chase it. There would be considerable noise from their own engines and propellers and they would not have the relative quiet needed for most effective use of underwater sound-locating devices, he said. In addition, the atomic submarine itself would be much quieter than one of conventional type.

Gas-Turbine Launch

A 60-FT launch fitted with two 120-hp gas-turbine engines was demonstrated recently by the Rover Company, Ltd., Meteor Works, Solihull, Birmingham, England, according to *Engineering*, October 20, 1950. The two turbines are similar to the one used in the Rover gas-turbine automobile described in the May, 1950, issue of MECHANICAL ENGINEERING, and although limited at present to a continuous output of 120 hp, the company hopes ultimately to develop them to produce between 180 hp and 200 hp. The Admiralty have placed an order with the Rover Company for a number of the engines.

How to Obtain Further Information on "Briefing the Record" Items

MATERIAL for this section is abstracted from: (1) technical magazines; (2) news stories and releases of manufacturers, Government agencies, and other institutions; and (3) ASME technical papers not preprinted for meetings. Abstracts of ASME preprints will be found in the "ASME Technical Digest" section.

For the texts from which the abstracts of the "Briefing the Record" section are prepared, the reader is referred to the original sources: i.e. (1) The technical magazine mentioned in the abstract, which is on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., and other libraries. (2) The manufacturer, Government agency, or other institution referred to in the abstract. (3) The Engineering Societies Library for ASME papers not preprinted for meetings. Only the original manuscripts of these papers are available. Photostat copies may be purchased from the Library at usual rates, 40 cents per page.

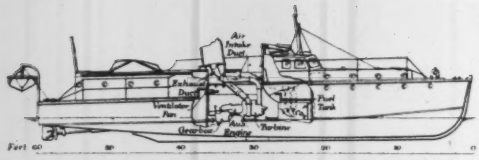


FIG. 1 LONGITUDINAL SECTION THROUGH LAUNCH SHOWING PART OF ENGINE ROOM

Each turbine consists of a single-stage centrifugal compressor fitted with a single-sided impeller and designed to operate at a maximum speed of 40,000 rpm. This delivers the air to two combustion chambers similar in design to those used on an aircraft gas turbine. From the combustion chambers, the gases pass to the compressor turbine, the rotor for which is machined, complete with blades, from a Nimonic 90 forging. Behind the compressor turbine is the power turbine; this is similar in construction to the compressor turbine but has somewhat longer blades and runs at a maximum speed of 30,000 rpm. The two turbine runners are not mechanically connected, the compressor turbine driving the compressor and auxiliaries only, while the power turbine is coupled to the input shaft of a gear-reduction unit. Ground single-helical gears with oil-jet lubrication are employed in the reduction unit, the power turbine being mounted on the end of the high-speed pinion shaft. The reduction ratio is 7 to 1, and a gearbox of the Wilson epicyclic reversing type gives a further reduction of 3 to 1.

The auxiliaries in each case are mounted on the forward end of the engine. They comprise a starter motor, a generator, an oil pump, and a fuel pump. A normal car starter is used with a step-up gear of 3 to 1, and the generator is driven by a V-belt at a speed of 6000 rpm. The oil pump is of the gear type and supplies both the engine bearings and the reduction gears. The fuel pump is controlled on the spill principle. The output from the turbines is varied by altering the fuel delivered; this determines the speed of the compressor and, therefore, the power output, independent of the power-turbine speed. The controls are simple and neatly arranged. Each engine has a width of 2 ft 6 in., a length of 4 ft, and a height of 2 ft 6 in.; the weight is approximately 4 cwt (448 lb). They occupy very little space. At present, heat exchangers are not fitted; as a consequence, the fuel consumption is high, being of the order of 1.6 lb per bhp-hr at 100 hp and 1.25 lb at full power.

A suitable heat exchanger is being developed, however, and when this is fitted, it is hoped to reduce the fuel consumption of 0.8 lb per bhp-hr at full load. During trials the two turbines functioned satisfactorily and the most noticeable features were the absence of noise and vibration and their ready response to the controls. Originally the launch was fitted with three Diesel engines; the two gas turbines have been fitted in place of the wing engines, the center engine remaining in position to act as a stand-by and for operating the pumps.

Steam Central Stations

IN a paper delivered at the recent World Power Conference in London, England, excerpts of which appeared in the October, 1950, issue of *Combustion*, P. W. Thompson, vice-president in charge of engineering of The Detroit Edison Company, reviews operating experience of central stations in the United States.

He points out that operating experience with high-pressure high-temperature plants (2300 psi, 1050 F) and equipment has been satisfactory and not significantly different from that with earlier installations employing lower steam conditions. Modern American plants have shown an average annual availability of better than 90 per cent excluding periods of low demand during week ends and holidays. Availability expressed on this basis is somewhat different from that in which total time is used as a reference, but it is believed to be a better measure of dependability since it relates specifically to the periods when the equipment is, or might be, needed to meet load demands. Long-range scheduling of maintenance outages, careful planning of inspection procedure, and the use of multiple shifts in succession to lengthen the working time during maintenance periods have shortened equipment outage time by about one third during the past four years.

Experience of those plants employing the reheat cycle has been generally satisfactory, Mr. Thompson states. Operation of reheat equipment with extremely high pressures has been limited to two plants, one of which employs a natural-circulation steam generator at 2400 psi, while the other uses a forced-circulation boiler of the Lamont type at 2000 psi. In the older reheat installations, operation is somewhat more complicated than with the straight-through regenerative cycle, but in the newer installations the arrangement of the reheating surface in the steam generator is such that cooling of this section during starting or sudden loss of load is not necessary. Operation is thus considerably simplified.

TURBINE GENERATORS

The annual availability of turbine-generators excluding periods of low demand during week ends and holidays, averages 94 per cent. The steam turbine accounts for two thirds of the outage, while the generator, auxiliaries, and other related equipment account for the remaining one third.

Experience with modern turbine-generators has led some companies to extend operating periods to 40,000 or 50,000 hr between overhauls. Other companies have adopted the practice of opening turbines only when stage pressures or performance indicate the necessity.

In general, causes for outage of high-pressure high-temperature turbine-generators have been no different from those for units operating at lower steam conditions. The trouble responsible for the greatest loss of service is failure of buckets and blades in the moisture region. Such failures are either of a fatigue or a corrosion-fatigue nature. Remedial measures consist in the use of heavier blade sections and, in some instances, changes in shrouding or lashing wire design.

STEAM GENERATORS

The average annual availability of high-pressure, high-temperature steam generators is somewhat lower than the 94 per cent reported for turbine-generators. An important fact influencing this availability factor is that in nearly all cases, governmental agencies and casualty insurance companies require a complete yearly inspection of steam-generating equipment, whereas turbine inspections average once every three years.

The major cause of emergency outage of steam generators is failure of pressure parts, particularly tubes. Cleaning of external heat-exchange surfaces, replacement of worn combustion equipment, and repair of fans and other auxiliaries account for the remaining outage time other than scheduled annual overhaul.

METALLURGY

The failure in 1943 at a welded joint in a high-pressure high-temperature steam pipe without warning or suspicion of weakness was cause for extreme concern among operating companies.

Since this occurrence many examinations have been made of the welded joints in high-temperature steam power plants. Examinations have shown graphitization in medium-carbon steel at 800 to 875 F and in carbon, 0.5 per cent molybdenum, steel at 900 to 975 F. In general, where it has occurred, it has been evident within approximately 40,000 to 50,000 hr of operating service, although it may occur after longer periods of operation.

The results of investigation of the problem are that (1) high-aluminum-deoxidized steel is more prone to graphitization than low-aluminum-deoxidized steel, and (2) the addition of about 1 per cent of chromium to steel effectively prevents graphitization.

Several companies have replaced graphitized pipe with chromium-molybdenum pipe, and a number of companies have undertaken programs of rewelding the joints.

TRENDS

As to trends, Mr. Thompson indicated that practically all new capacity being installed in this country, or on order for new installations, has rated steam conditions above 800 psi and 800 F. The highest steam temperature specified is 1050 F at pressures from 1500 to 2000 psi. An increasing portion of the new capacity being added each year is designed for steam conditions closely approaching these upper limits.

It is expected that steam temperatures will exceed the present limit when suitable materials become economically practicable. The wartime development of "super" alloys for military purposes has accelerated metallurgical developments of materials for higher-temperature steam service.

There is a marked trend in new plant designs toward the reheat cycle to achieve further gains in thermal economy within the present temperature range, particularly for large-size units with anticipated high use factors.

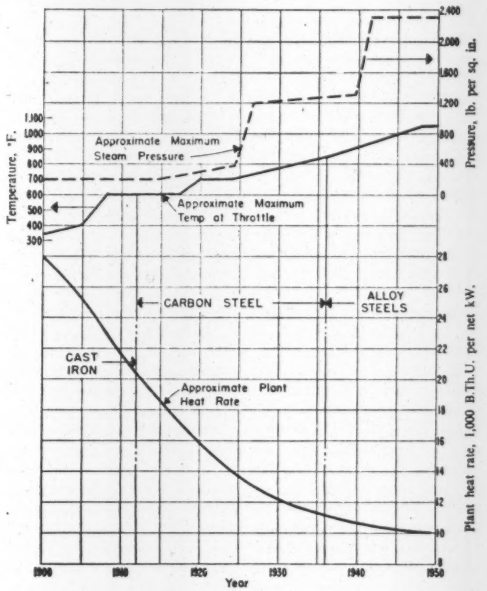


FIG. 2 CHANGES IN STEAM CONDITIONS AND PLANT ECONOMY SINCE 1900

The unit boiler-turbine arrangement contributes to operating simplicity and lower plant cost, and therefore has found increasing favor among utilities. Higher availability of boilers and turbines has been an important factor in the acceptance of this scheme. Unit boiler-turbine designs are well suited for the incorporation of reheat.

Having reached the point where scheduled capacity additions promise to overtake anticipated load growth and re-establish normal reserve margins, there is some renewed interest in superposed units for topping older plants to increase their thermal efficiencies.

To offset increasing costs of power plants there has been, and continues to be, a trend toward so-called outdoor and semioutdoor stations in regions enjoying milder climates. In these designs the elimination of varying portions of the building structures tends to reduce the cost per kilowatt of station capacity.

The large increases in loads on individual electric power systems, together with the more extensive interconnection of regional systems, have resulted in a trend toward generating units of larger capacity. Nearly all new units up to about 100,000 kw capacity are of the 3600 rpm design. Larger units are either of 1800 rpm design or of the cross-compound type in which the high-pressure element turns at 3600 rpm and the low-pressure element at 1800 rpm.

Further increases in thermal efficiency in future steam power plants are looked for through the use of higher pressures and temperatures. Further reduction in operating personnel through the use of centralized controls is expected to contribute to holding production costs to a minimum. Standardization of equipment designs, where possible, together with advances in the art of plant design and construction, are relied on to help combat tendencies that are apparent toward further increases in the first cost of new stations.

Corrosion-Resistant Pump

A NEW pump for purposes requiring wear and corrosion resistance, as well as sanitary qualities, has been developed by the Waukesha Foundry Company, Waukesha, Wis., and is described in *Inco*, vol. 24, no. 2. This is the Waukesha ball-bearing unit which has been found highly successful by processors of milk, canned foods, carbonated beverages, liquors, cold cream, pharmaceuticals, paints, adhesives, and a wide range of other products.

The pump is a positive-displacement twin-blade impeller type, producing a smooth even flow with minimum pulsations. Its capacity is regulated by the number of revolutions per minute at which the pump is driven. It is made in five sizes handling 250 lb to 60,000 lb per hour against a 100-lb head. Units are designed to operate at speeds up to 600 rpm.

The pump is precision-machined and built. Clearances maintained between the impellers and the body range from 0.001 in. on the smaller-size pumps to 0.003 in. on the larger-size pumps. Castings of four different "white metal" copper-nickel alloys containing 23 to 30 per cent nickel are used for the pump body, cover, impellers, and rotary seal parts; and a fifth alloy containing 20 per cent nickel is used for the gear case and cover of the deluxe model. A "17-12" chromium-nickel (AISI Type 316) stainless-steel spring keeps the proper pressure on the rotary seal.

The entire pump head, including all rotary seal parts, is easily dismantled and reassembled for quick and thorough daily cleaning. The bright, highly polished, nonpitting surfaces assure efficient sanitary operation and easy maintenance. For the pump shafts, solid one-piece castings of Waukesha No.

18 were chosen because of its high tensile strength and torque-resisting qualities. The pump body, cover, and rotor retaining nut all are made of free machining alloys which wear well with other Waukesha metals and can be brought easily to a high polish when cleaned.

In models where rotary-seal outer cases and rotary-seal nuts are used, the rotary-seal outer case and nut must have wear-resisting qualities and are made of alloys No. 0 and No. 8, respectively. No. 0 alloy gives the necessary hard close grain. The gear case and cover are made of general-purpose alloys which take on high luster when polished.

Where requirements demand, the sanitary pump may be obtained cast in 18-8 austenitic stainless steel. In this case the impellers are made of No. 50, an alloy which contains over 50 per cent nickel, which has excellent nongalling properties when operating in contact with stainless steel.

Multiple-Alloy Steel

THE first of a new group of alloy steels to be known as T-steels, has been announced by Carnegie-Illinois Steel Corporation. "Carilloy" Tl is a multiple alloy plate steel, which is said to combine extremely high strength with excellent ductility and toughness, even at subzero temperatures.

With almost double the strength of high-strength low-alloy steels and almost triple that of ordinary welding-grade structural steels, Carilloy Tl promises to effect considerable savings in applications calling for heavy steel members of $\frac{1}{2}$ in. thickness and up. It is designed to be at least two to three times as resistant to atmospheric corrosion as plain carbon steels.

This plate steel is furnished heat-treated to a minimum yield strength of 100,000 psi. It maintains adequate toughness even at this high level of strength and is suitable for application where extreme high strength and good weldability are required.

It has been established definitely that welding does not adversely affect the properties of this steel, which has been designed to require no special preheating or postheating treatments in welding or gas-cutting operations beyond those normally used with ordinary structural steels. If low-hydrogen-type electrodes are used, the new steel is not susceptible to under-bead cracking. Electrodes that will develop the full strength of the Tl basic metal are available and should be used if 100 per cent joint efficiency is needed.

No special equipment and procedures are required for fabrication. Bending or forming may be accomplished cold if sufficient power is available to overcome the high yield strength of the steel. If hot-forming is necessary, the operation must be followed by heat-treatment which involves liquid quenching and tempering after the hot-forming operation. Corporation metallurgists will give the user the necessary heat-treatment information for this work.

It has now been established that ordinary room-temperature testing procedures will not adequately predict the behavior of welded structures under adverse conditions of restraint or when used at low temperatures. For this reason, an extensive testing program was initiated on this steel, utilizing various types of tests to determine its tendency toward brittle failure under various conditions. The results of this testing program indicate that Carilloy Tl possesses excellent toughness under such conditions. This feature gives the user added insurance against brittle failure.

The unique properties of this new steel are obtained by blending multiple-alloying elements, coupled with precision heat-treatment. Carbon content is restricted to 0.18 maximum to promote ease of welding and gas cutting.

Titanium for Airplanes

TITANIUM is now being given serious consideration by the U. S. Air Force as a possible structural material for aircraft, it is reported in an article in the CADO *Technical Data Digest*, November, 1950. Nonstructural components, such as deicing ducts, fittings, and firewalls are already in production, while structural components such as wing and fuselage sections are in an experimental stage.

Although titanium was actually discovered in 1791, its usefulness had been neglected until a few years ago because other metals such as aluminum, magnesium, iron, and their alloys served man's needs adequately. However, the progress made in metal-refining processes, and the need for additional high-strength high-temperature metals have brought titanium into its own.

Since the beginning of the titanium-development program, engineers of the Materials Laboratory, Engineering Division at Air Materiel Command Headquarters, have been busy improving production processes used in titanium reduction, and developing better titanium alloys. In co-operation with the Battelle Memorial Institute of Columbus, Ohio, and other Air Force contractors, the Materials Lab has produced a large number of experimental titanium alloys, some of which have a tensile strength as high as 200,000 psi.

One of the results of this development is the present method of melting titanium in a water-cooled copper crucible. Another is a method of continuously reducing and melting the titanium in the production process. This is a big step toward lowering the production cost and simplifying the refining process.

On the fundamental side of the development program, a phase-diagram investigation is being conducted. The results of this research are expected to contribute a great deal to the understanding of the fundamental properties of titanium alloys and their heat-treating processes.

Two research and development projects on titanium structures for aircraft and missiles have been initiated by the Engineering Division's Aircraft Laboratory. One of these projects is the design of the complete wing for a supersonic missile. This project is directed toward obtaining a high-temperature-resistant structurally efficient missile component, completely constructed of titanium alloys. It is also expected to provide valuable experience in fabricating structures from this new material. The other project calls for the design and fabrication of a complete aft fuselage section for a jet fighter, replacing all corrosion-resistant steel-alloy materials with titanium alloys.

The fuselage section will include titanium forgings and rivets as well as sheet material. This procurement will provide a primary structural aircraft component which is capable of operating at elevated temperatures, and will also provide experience in establishing design criteria, service test data, and fabrication techniques.

The extreme interest in titanium and titanium alloys which is held by AMC's Engineering Division is due to the fact that wherever it is possible to substitute titanium, gage for gage, for stainless steel, a 40 per cent saving in weight results. Portions of aircraft structures immediately surrounding jet engines, tailpipes, etc., and particularly afterburner installations, must in many cases be fabricated from a corrosion and heat-resistant steel. In the case of a particular heavy bombardment airplane, it is conservatively estimated that 2000 lb can be saved if titanium is made available in sufficient quantities for the desired application. Such weight savings as these are extremely valuable in extending the range of tactical aircraft. Because of the high physical properties of titanium, gage-for-gage substitutions seem feasible in most cases.

Titanium is one of the seven most important and potentially plentiful metals having a melting point higher than iron, nickel, and cobalt from which present commercial heat-resistant alloys are made. Titanium occupies a most favorable position with regard to reserves of ore on the North American continent, such reserves being estimated at 110 million tons of contained metal. Commercially pure titanium is a light, strong, ductile, and corrosion-resistant metal.

Engineers of the Materials Laboratory's Metallurgical Branch have been comparing the properties of titanium and its alloys with those of aluminum and magnesium alloys and steel. Here are some of the things they found:

At room temperature, as indicated by yield and ultimate tensile strength, unalloyed titanium is superior to magnesium and aluminum alloys, carbon steels, and annealed 18–8 stainless steel. Only heat-treated alloy steel and cold-worked stainless steel show greater strength than unalloyed titanium, and only heat-treated steel is similar in strength to a high-strength titanium alloy.

On a strength-weight basis, the cold-worked titanium and the titanium alloys are equal to or superior to the best of the other materials.

A comparison of the elastic buckling of slender and wide columns on a strength-weight basis indicates that titanium is superior to steel but inferior to aluminum and magnesium alloys. Titanium has a useful creep strength at temperatures as high as 1000 F, whereas aluminum and magnesium alloys do not have any useful load-carrying ability at temperatures above 600 F. In fact, titanium is stronger at 800 F than either aluminum or magnesium alloy at only 400 F.

Available creep data for titanium containing small but undetermined amounts of carbon, oxygen, nitrogen, and tungsten show it to possess properties that are intermediate between those of the best aluminum alloys and steel.

Airplane Starters

ALL three branches of the Armed Forces are constantly striving to keep the number of stock items in use to a minimum. Moreover, they continually try to make many of the parts in these items interchangeable.

Following this policy, engineers in the Equipment Laboratory at Air Materiel Command Headquarters have come up with three easily transportable power-plant starters designed to take care of all airplane starting needs now and in the foreseeable future. The new starters are described in the October, 1950, issue of the CADO *Technical Data Digest*.

Besides standardizing existing power-supply units, the new developments should prove advantageous because about 80 per cent of the parts in all three are interchangeable. These units all use the same engine, dolly, housing, control box, gear-case assembly, and winterization equipment. In addition, the generating and control equipment, as well as many other components, are standard AF and AN parts, exactly like those now used in certain planes.

All this is expected to result not only in a reduction of spare-parts stocks for supply and maintenance of these power units, but also in a reduction of procurement costs.

Designated Ground Power Plant Types C-21, C-22, and B-10, the new units are employed as a reciprocating-engine starter, a jet-engine starter, and starter for the power plants of the B-36 bomber, respectively. In addition, they can be used to check out aircraft electric systems, and as electric ground power for local aircraft maintenance. The B-10 unit can also operate the d-c bomb-hoist equipment of the B-36 aircraft.

In the event a larger power output than one of the plants can provide is needed, two of the power plants can be connected in parallel, thus doubling the output.

Manufactured by the Lycoming-Spencer Division of the AVCO Manufacturing Corporation, all three units use a Lycoming four-cylinder, air-cooled, opposed-piston engine. Considerably lighter than comparable water-cooled engines, this power plant is rated at 90 hp at 130 F.

Essentially, the three units are alike, except for the generating equipment. The C-21 is equipped with one 400-amp d c generator and one 8-kw single-phase alternator for producing alternating current. This unit has a capacity of 11 kw d c and 8 kw a c, sufficient for starting reciprocating engines. The complete unit weighs 1390 lb as compared to 2600 lb, the weight of the old liquid-cooled-engine type.

The C-22 is equipped with two 400-amp d-c generators and one 8-kw single-phase alternator. This unit has a capacity of 22 kw d c and 8 kw a c. Complete, it weighs 1550 lb. Actually, for some of the larger jet engines, it can produce 30 to 35 kw d c for short periods.

The B-10 is equipped with one 300-amp d-c generator and one 40-kva 30-kw alternator, sufficient to start the engines of the B-36 bomber It weighs 1480 lb.

The engine and gear case of all three units are mounted on a three-wheeled dolly to provide mobility and a rigid frame for the power plant. The dolly is provided with a tow bar, lunette eye, and pneumatic tires, permitting the power plant to be towed at speeds up to 20 mph. The turning radius is small for ease of handling on the flight line and one man can easily move the unit by hand on level surfaces.

A speed-increaser gear-train assembly is mounted at the rear of the engine, behind the engine-cooling fan. The gear train, driven from the engine crankshaft, supplies power to the electrical generating equipment through a vibration damper. The gear-train housing is fabricated of aluminum casting for light weight. The B-10 and C-21 gear cases are completely interchangeable.

The same metal control box is used in all three power plants. This box houses all electrical instruments, control equipment, and engine instruments. All wiring enters the box through quick-disconnect plugs, allowing the complete box and its components to be removed as a unit for inspection and maintenance. The entire box is shock-mounted for protection against engine vibration.

Rigidly constructed of aluminum sheet, the protective housing for all three units provides a barrier against rain, snow, sand, and dust. All openings are sealed to maintain a tight enclosure which is heated by a 20,000-Btu gasoline heater for quick starting at temperatures down to —65 F. Thermostatically controlled louvers permit engine-cooling air to flow through the unit. Access doors permit normal servicing with comparative ease. The entire housing can be removed as a single assembly for ease of major repair or overhaul.

Smokeless Jato

A NEW JATO (jet-assisted take-off) aircraft booster rocket, which uses smokeless powder and weighs considerably less than present models, has been developed for the Navy for use on various military aircraft.

The Army and Air Force also contributed funds for development of the new JATO units, and all three services plan to use them.

The new JATO booster rocket was developed by the Allegany Ballistics Laboratory, Cumberland, Md., under a contract with the Navy Bureau of Ordnance.

Although the new unit weighs considerably less than JATO's now in use, it provides an equal amount of thrust. The weight saved adds to the pay loads of aircraft which require JATO in take-offs from aircraft carriers or runways.

The use of smokeless powder as a JATO propellant will be particularly advantageous aboard aircraft carriers, where clouds of smoke given off by units now in use may hamper operations. Smokeless powder has been used for some time as a propellant charge for artillery and naval guns.

Aircraft Gas Turbines

THE first public glimpse of the General Electric Company's Aircraft Gas Turbine Laboratory, including a tour of GE's aircraft gas-turbine test, development, and production center at Lynn, Mass., was afforded members of the technical press, civic leaders, and Air Force and Naval officers on Nov. 14–15, 1950.

AIRCRAFT GAS TURBINE LABORATORY

In the new Aircraft Gas Turbine Laboratory dedicated on November 14, 1950, in honor of the late Dr. Sanford A. Moss, altitudes of 70,000 ft and temperatures of minus 100 F, can be simulated. Dr. Moss, who was a Fellow of ASME, received the Holley Medal from ASME in 1945 for his many contributions to the development and application of turbosuperchargers to internal-combustion engines.

The laboratory is to be used for components testing with facilities for full-scale and scale-model testing of compressors and combustion systems. Turbine testing, both scale model and full scale, at present is conducted elsewhere in the center.

A compound steam turbine provides 35,000 hp for driving the large experimental compressors under test in the laboratory. The plant consumes 255,000 lb of superheated steam per hr, and to meet this demand a large addition has been made to the River Works powerhouse.

More than 14,000,000 cu ft of air per hr can be cooled to minus 70 F, by means of a cooling cycle which utilizes water from the adjacent Saugus River and four sets of refrigeration compressors and turbines. When in full operation, the laboratory requires 4,800,000 gal of water per hr.

The cylindrical steel tank in which compressors are tested is 40 ft long and 10 ft in diam. It is insulated on the compressor inlet side with eight layers of polished aluminum sheets. The high-temperature high-pressure discharge section is insulated

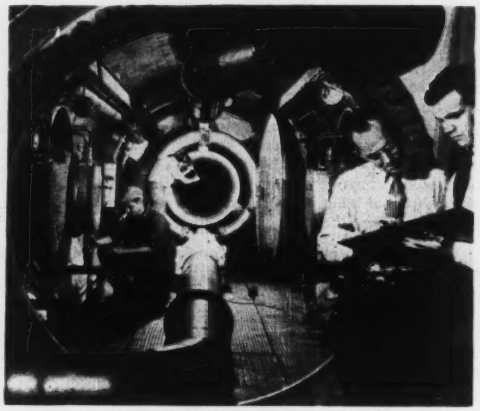


FIG. 4 INSIDE THIS INSULATED AND REINFORCED-STEEL CYLINDER IN THE GENERAL ELECTRIC COMPANY'S AIRCRAFT GAS TURBINE LABORATORY, EXPERIMENTAL COMPRESSORS FOR JET ENGINES ARE BEING OPERATED UNDER TEST CONDITIONS NEVER BEFORE ATTAINED

on the outside with four-inch layers of glass wool. The test stand operates either closed or open-cycle, and air flows of 320 lb per sec (which would completely change the air in a six-room house in 2 sec) can be handled.

Readings are said to be the most precise ever obtained in such types of tests. All air flows and temperatures are measured in triplicate. In compressor tests, for instance, engineers take more than 700 readings covering temperatures, air flows, air pressures, torque, blade strain, vibration, and blade clearances. There are 250 control valves alone.

The laboratory's combustion test stand can be cut in directly on the closed-cycle system and supplied with air discharged by the test compressor. It can burn fuel at the rate of 50,000 lb per hr and permits operation of complete combustion assemblies over a range of pressures from sea-level atmospheric to 250 psi. Exhaust gases are measured for temperature and pressure distribution prior to discharge. Exhaust air is passed through a water "bath" to bring temperatures from 1800 F to below 400

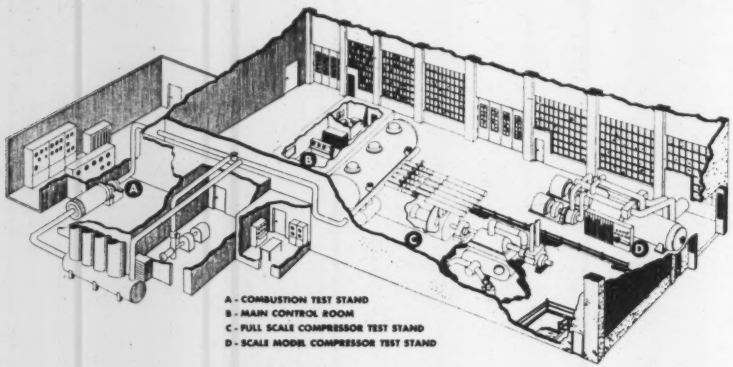


FIG. 3 GENERAL ELECTRIC AIRCRAFT GAS TURBINE LABORATORY, LYNN, MASS.

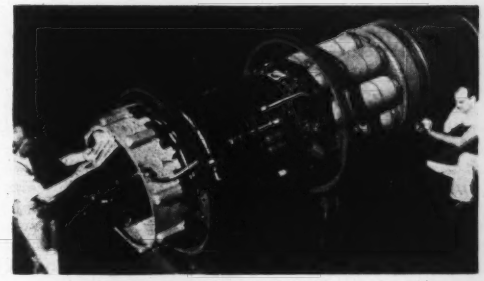


FIG. 5 THE J-47-23 AIRCRAFT JET ENGINE, ONE OF TWO GENERAL ELECTRIC COMPANY "ALL WEATHER" TURBOJETS

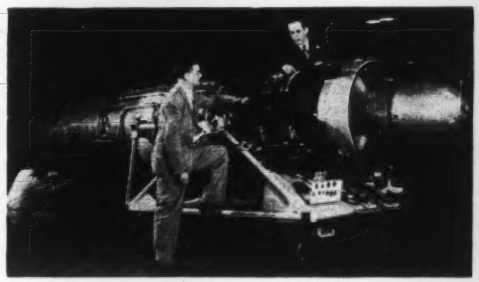


FIG. 6 THE J-47-GE-17 TURBOJET ENGINE DEVELOPED BY G-E IS MADE READY FOR TEST

(The engine is equipped with an afterburner and has a dry static thrust rating of more than 5200 lb. Burning of additional fuel in the afterburner to produce added thrust, independently of the basic engine, results in complex control problems which could not be handled effectively by the hydraulic engine controls currently used on jets. G-E engineers devised electronic controls which, by means of "brain boxes," automatically regulate fuel flows to the engine to bring about optimum performance.)

F before it is discharged through 50-ft pipes to the four silencers outside the building.

NEW ALL-WEATHER GAS TURBINES

In conjunction with the Laboratory dedication, G-E also unveiled the nation's first "all-weather" axial-flow gas-turbine engines. They are said to be the most powerful turbojets ever announced by the company and are rated in excess of 5200 lb of thrust. These engines are already in production.

The engines, completely anti-iced, are being built for Air Force planes and make possible the successful completion of missions under severe icing conditions.

Both also have special ignition systems that make possible starts at altitudes of 50,000 ft.

They have been designated the J-47-GE-23, and the J-47-GE-17. The latter will be used in North American's F-86D, an even faster version of the world's speed record holding F-86.

It was pointed out that the "17" engine was being built with a "considerable reduction" in strategic materials which would be in extremely short supply in a national emergency.

Basically, the two new engines are the same. However, the J-47-GE-17 is equipped with an afterburner, an elongated tail pipe in which additional fuel is burned to provide added thrust or driving force, and electronic controls.

Although the basic engines are identical in size to current-production models of the J-47, they are more powerful. The J-47 is the Air Force's No. 1 production engine and is the power plant for such planes, in addition to the B-47 and the F-86, as the North American B-45, four-jet bomber; Republic's XF-91, needle-nosed interceptor; the XB-51, three-jet Martin bomber; and the intercontinental B-36 bomber, on which four jets have been added to provide great power boosts for take-off and combat use.

"Icing up" has heretofore been a knotty problem in jet operation. Supercooled water droplets, striking the air inlet at the nose of the engine, form into ice crystals and within seconds can block passage of air into the engine. Pilots have had to avoid such supercooled clouds, or if they strike them, immediately cut off power and glide to a lower level with a resultant mission failure.

General Electric engineers overcame the icing problem by giving their engines "hot noses." Hot air from the engine's compressor is bled to hollow parts of the nose. These parts include the air-inlet guide vanes, fairings, and support struts. Temperatures are high enough to melt any ice crystals forming. In addition, the air inlet screen—designed primarily to keep foreign objects from going through the engine on the ground—has been made retractable. The screen, which could serve as the foundation for an ice "dam," is retracted soon after the plane is air-borne.

GAS-TURBINE MANUFACTURING

G-E production facilities of precision-made aircraft jet engines on an assembly-line basis to meet expanding Air Force needs were publicly visited for the first time on November 15.

The inspection covered the entire range of manufacturing operations, from the processing of raw materials into finished parts at the nearby Everett plant, to the loading of completed engines into specially built cylinders for shipment to the Air Force. Also shown were forging operations and turbosupercharger manufacture and assembly.

As one views the manufacturing process it is evident that most of the parts must be precision-built. But beyond that

FIG. 7 PRECISION-BUILT JET ENGINES FOR AIR FORCE PLANES MOVE DOWN THE ASSEMBLY LINES IN EVER-INCREASING VOLUME AS PRODUCTION IS STEPPED UP TO MEET DEFENSE NEEDS

(This view of one of the main assembly lines in the G-E's River Works plant at Lynn, Mass., shows J-47 engines being assembled prior to their "green" run in test cells. After the green test the engines are completely disassembled, thoroughly inspected, and reassembled for final operating tests before shipment to the Air Force.)

FIG. 8 A G-E WORKMAN CHECKS FITS OF BUCKETS TO TURBINE WHEELS FOR J-47 AIRCRAFT JET ENGINES

they must be designed to withstand terrific stresses at temperatures as high as 1600 F.

The visitors were shown the stringent tests to which parts are subjected before assembly. For example, compressor rotors are placed in an evacuated pit and rotated at speeds far beyond those to which they will be subjected in an airplane. The rotors are literally urged to fly apart. Following this overspeed run, they are checked for balance before assembly into engines.

Although engine production figures could not be revealed, hundreds of tanklike shipping containers were stacked around the plant.

MEASUREMENTS LABORATORY

Considerably reduced panel space has forced manufacturers to develop pint-size instruments able to do the same work as their larger World War II counterparts. Furthermore, these instruments must be more accurate, for the margin of error is less for a pilot hurtling through space at near-sonic speeds. And these instruments must interpolate for the pilot who does not have time to make estimates and calculations based on information supplied by simple indicating instruments.

Instruments only one third as large as their counterparts of four years ago were shown during a visit to G-E's new Measurements Laboratory.

Engineers pointed out that the trend is toward even smaller cockpit instruments and more automatic control devices that will entirely relieve a pilot of many duties now occupying his attention.

Many of today's cockpit instruments actually are "miniature computers," which immediately flash to the attention of the pilot a situation that must be remedied. Typical of these is a position indicator no larger than a penny matchbox which tells a pilot, at a glance, whether his landing gear is up, down, or in between, without requiring him to devote any time to calculation or judgment.

In order that other data, such as temperature, safe operating pressures, and fuel quantity can be similarly indicated in a small space, variations of this precise instrument are being developed.

Another example in which two precisely accurate instruments have been combined in a single small space on the cockpit panel is the directional gyrocompass system. In this instrument the directional gyro has been reduced in size, mainly through the use of a new tungsten alloy, and combined with a small remotely located compass system to maintain a stable and accurate indication of direction at all times. A subtransmitter in the center of the instrument dial assures the pilot that the directional gyro at all times "jibes" with the compass needle.

It was pointed out that the instruments of tomorrow will combine many ordinary indications, thereby contributing to completely automatic operation, but pilots will always have to be alert to changes in turbine speeds, particularly when starting jet engines. To meet this need, tachometers, which determine the speed at which turbine wheels spin, are being developed that accurately indicate running speed from three per cent of full speed all the way up to full throttle. Accuracy in older tachometers was required only when the engines were operating at near full speed.

Missile Test Center

THE most modern and complete missile testing station in the world is fast taking shape at Point Mugu, Calif., with the completion of the first increment of construction at the U. S. Naval Air Missile Test Center there, it is revealed in the November, 1950, U. S. Navy, *Civil Engineer Corps Bulletin*. The center was formed in 1946 out of a merger of the former Naval Air Facility, Point Mugu, and the Pilotless Aircraft Center at NAS Mojave.

In June, 1948, Congress authorized $30,000,000 for the project, and appropriated $14,000,000 for initial construction and contract obligation. Before contracts could be advertised for new roads, utilities, and buildings, it was necessary to fill the low-lying area with approximately 3,000,000 cu yd of material dredged from a shallow lagoon.

Aviation facilities were the major item of construction under the initial appropriation. A standard double hanger of 110,000 sq ft floor space was completed in May, 1950, and the existing runway was enlarged to a length of 5500 ft and a width of 200 ft, with a parallel taxiway and parking aprons.

Another major item was a new deep well system with a tested capacity of 2,000,000 gal per day. Other new utilities include gas, electric, telephone, and sewer systems.

Radio facilities include transmitter and receiving buildings on Laguna Peak and a transmitter building at Main Base. Other buildings are for test and evaluation, small missiles, instrumentation, and miscellaneous operations. In addition, there are an Administration building, a Security building, and miscellaneous personnel structures.

An Air Blast Facility for supersonic and transonic tests is being erected with special funds allocated by BuAer. The boilers, turbines, and much of the piping for this project have been salvaged from the U. S. S. *Independence*, of Bikini fame.

The final increment of construction is planned contingent upon appropriation of the remaining $16,000,000, and will consist of 34 separate projects devoted mainly to actual missile launching and other technical installations.

Supersonic Prop Spin Pit

EARLY this year the world's first supersonic propeller "spin pit" will be in operation at Aeroproducts Division plant of the General Motors Corporation in Dayton, Ohio, according to the November, 1950, issue of the CADO *Technical Data Digest*.

Developed under contract with the Navy, the pit is designed to accomplish various mechanical tests upon supersonic propellers, also being developed under contract with the Navy and the Air Force.

A steel cylinder, 12 ft 10 in. in diam and 7 ft 10 in. high, is sunk below ground level and secured with an air-tight seal to a concrete base. A removable steel dome provides for installation and removal of the supersonic propellers.

The chamber will be evacuated of atmosphere by a vacuum pump to 0.01 atm. The reduced atmosphere permits the use of a low-horsepower (450-hp R-985) engine to rotate the propeller at a relatively high speed.

The propeller is rotated in a horizontal plane with a shaft extending vertically through the dome to a right-angle gearbox. The gearbox in turn is driven by a shaft extending to the engine. An Aeroproducts propeller mounted on the engine acts as an engine load, cooling fan, and governor.

Although present plans anticipate only mechanical testing, it would be possible by the use of a high-horsepower engine and suitable gearbox, to simulate various atmospheric pressures and altitudes to obtain data concerning aerodynamic characteristics of supersonic propeller blades.

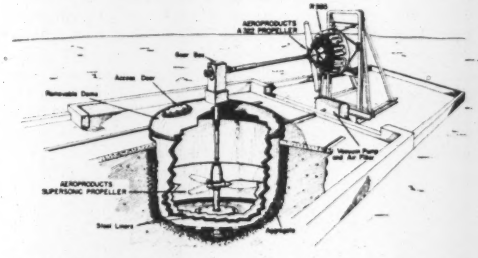


FIG. 9 NEW SUPERSONIC SPIN PIT WILL TEST PROPS DESIGNED TO BE USED WITH HIGH-HORSEPOWER GAS-TURBINE ENGINES

Most data concerning the Aeroproducts supersonic propellers are classified and may not be released. However, blades for the supersonic propellers are of thin-section design with a tapered planform. In spite of earlier predictions, sufficient test data are now available to justify theoretical calculations showing the continuation of the present high level of propeller efficiency through the supersonic range.

It is anticipated that power plants to drive supersonic propellers will be of the high-horsepower turboprop class.

Continuous Casting

THE present status of the continuous casting of steel and the possibilities it holds for the New England area after 1952 were outlined recently before the American Academy of Arts and Sciences in Boston, Mass., by Isaac Harter, chairman of the board of The Babcock & Wilcox Tube Company.

Discussing the development of the new steelmaking process which is being carried on jointly by The Republic Steel Corporation and his company, Mr. Harter stated that continuous casting of steel could presently be applied to about 15 per cent of the nation's output and that improvements now being perfected would increase its application to between 25 and 30 per cent of steel production.

Successful large-scale experimental continuous casting of steel, which had been sought by the steel industry for more than 100 years, was announced two years ago by the two companies. The pilot plant for the operation is located at the B & W Tube Company works in Beaver Falls, Pa. The two companies are working steadily to bring the process to a point where it can be applied by industry to reduce the cost of steelmaking and make possible the construction of steel mills for making moderate quantities of steel without resorting to the tremendous expenditures required for plants of conventional design.

In analyzing the New England situation, Mr. Harter pointed out that the first decision to be made would be whether a new steel mill should be fully integrated—that is, start with coal, iron ore, and other basic materials—or nonintegrated and start with the melting of scrap steel obtained locally. This is a basic question, he said, because, even though an economical supply of metallurgical coke may be available, cheap iron ore will not be available for two or three years. Even then, the most economical supply will be obtainable only from deposits which normally would require sea transportation subject to the hazards of war. Furthermore, the investment required for an integrated steel mill of the same annual capacity would be two to three times that of the nonintegrated mill.

With regard to various studies being made in the New England area to secure a more economical source of steel, Mr. Harter pointed out that if these studies result, as they probably will, in showing that the local supply of scrap and the demand for steel products conveniently made from it are in reasonable balance, then it would seem that there is much to be said for beginning with scrap, and leaving the relatively large financial and supply problems involved with a fully integrated steel mill to some later time.

Mr. Harter explained that at present it was possible to cast oval cross sections of 25 to 40 sq in. by the continuous-casting method. This size, he pointed out, lends itself well to rolling into small bars, narrow-width strip steel, rounds for wire products, and many other items, all of which fit the requirements of New England industry. He added, moreover, that during the year there would be tested a new mold which will make it possible to produce a casting with a cross section of 100 sq in., suitable for rolling into 26-in. strip in a continuous sheet rolling mill. This mold will also be constructed so that it can be enlarged even further. In advising New England industry to consider continuous casting, Mr. Harter also said that it is believed that during 1952 continuous casting will have proved itself in production as a low-capital and high-yield method of making steel warranting its further and general extension in the steel industry.

Furnace Charging

CHARGING an open-hearth furnace by the conventional method requires that scrap iron and other charge materials be trundled in on rails on a string of buggies, past the several furnace doors, and each furnace charged as required. While the cars are stopped to charge one furnace, no cars can pass to reach those farther down the line.

A new system of flow described in the *Westinghouse Engineer*, November, 1950, eliminates this possibility by allowing individual charging of any furnace at any time. This method is being installed in a plant of the Armco Steel Company, where four special hydraulic hoists will serve three open-hearth furnaces. Each furnace will have a hoist on either side of its furnace doors. The hoist platforms, some 10 × 20 ft in size, will be loaded with one charge buggy per elevator on the yard level. Due to the plant layout involved, the elevator will rotate 90 deg on its way up to the furnace floor level (about 20 ft above yard level), so that the buggy can be unloaded in line with the furnace doors. All buggies will, of course, run on tracks throughout the length of their journey.

The hoists to accomplish this will be designed to lift a 45,000-lb load in 30 sec, or a maximum of 60,000 lb in 38 sec.

With the flexibility and speed that this system will allow, charging time for one furnace will be cut from $3^1/_2$ to $1^1/_2$ hr, i.e., a furnace will be charged with its 150-ton load in less than half the usual time.

Underwater Photography

MOTION pictures of the expansion and contraction of explosion bubbles, taken at depths as great as two miles under the surface of the ocean at a rate of 20,000 frames per second, are helping U. S. Navy scientists to gain new knowledge of the behavior, effectiveness, and design requirements of underwater explosive weapons, according to an article by Paul M. Fye, Naval Ordnance Laboratory, Silver Spring, Md., in the October, 1950, issue of the *Journal of the Society of Motion Picture and Television Engineers*.

Asserting that high-speed photography of explosion phenomena has advanced in the past decade from a curiosity to one of the most valuable tools for the study of explosions, Dr. Fye points out that two general approaches have been developed: (1) Photography of shock waves by means of a short-duration light source, and (2) motion-picture photography of the oscillations of explosion bubbles.

Concerned with pioneering work in the latter field at the Woods Hole Oceanographic Institution at Woods Hole, Mass., and at the Naval Ordnance Laboratory, all involving photography in actual ocean depths, supervised from a ship, with explosive charges ranging from 1 oz to 300 lb, the article states that most earlier work has been confined to tanks with a charge of only about 1 gram.

The explosion bubble, Dr. Fye explains, is a gas globe formed by the hot expanded gaseous products of detonation. Special requirements for photography of the repeated collapse of the globe are: (1) Sufficiently clear water to permit proper spacing of equipment and explosive charges; (2) appropriate cameras in water and explosion-resistant cases; (3) suitable light sources; (4) synchronization of lights and camera with the detonation; (5) precise speed control of the camera or timing marks on the film; and (6) a rig for mounting and maintaining the position of each component.

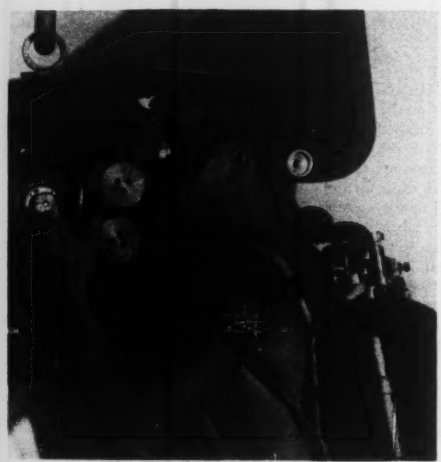


FIG. 10 PHOTOGRAPHER DIVER IN PHOTOGRAPHING POSITION

Because the restricted angle of view under water necessitates placing the camera a considerable distance from the object in order to obtain a suitable field, very clear water was essential. It was found off the Florida coast near the Bahamas and in the Caribbean Sea.

The cameras used—an Eastman Hi-Speed, a 35-mm Fastax, and a rotating-mirror frame camera (essentially a modified Bowen) designed by NOL—were shock-mounted in heavy water-tight cases. The NOL camera, used for studies at the greater depths, was enclosed in a 22-in-ID spherical case having a wall $1^1/_4$ in. thick. The camera lens viewed the explosion through a 1-in-thick window covering a $1^1/_4$-in. opening in the wall of the case.

In this camera, the image is focused on a spinning mirror which has the focal axis of the taking lens system for its axis of rotation. The plane of reflection of the mirror is 45 deg to this axis. The image is thus reflected through the framing lens to the stationary film. One hundred framing lenses provide 100 pictures. With the mirror revolving at the rate of 18,000 rpm, 100 pictures can be taken at the rate of 30,000 frames per second. An auxiliary shutter prevents multiple exposure. Such frame speeds were required for the very deep photography, where oscillations of the explosion bubble are much more rapid than in shallow water. The light source most commonly used consisted of a number of focal plane flashbulbs having a duration of about 70 milliseconds. Synchronization of events with a precision of the order of $^1/_4$ millisecond was required.

Democracy?—What For?

(Continued from page 8)

society in which he lives. We make a very grave error when we feel no personal shame or blame for corrupt politics and bad government. Such blights upon our land are wiped out only when people determine that it shall be done and then make it their personal business to go out and do it.

Is it not tragic that it becomes necessary to plead with people that they recognize their responsibilities as citizens? Are we so numb to the miseries of tyranny that we fail to remain aware of our part in guarding freedom? We accept the luxury of freedom with the same nonchalance that we accept hot and cold running water, fresh milk in a bottle, electric light, ready-made clothes, a city's sewage system, or the telephone. All these things, and more, we can have by writing checks to pay for them. But none of us is wealthy enough to buy himself an abundance of freedom.

FREEDOM, THE REWARD OF SACRIFICE

Freedom can be attained only through the efforts of people—*all* the people. The motivation that brings men to work and sacrifice in order to maintain freedom must be one derived from enlightened selfishness and hardheaded realism. There is no sound basis for one to feel that he is high-minded and self-righteous when he undertakes to shoulder his civic responsibilities. He and his children stand to benefit as much as anyone from these efforts.

It is easily understood, therefore, that democracy is the most difficult form of government to practice, but its rewards are by far the greatest. In order to comprehend their full value we must continually measure them against history's record of the despair of the enslaved. It is easy to lose one's appreciation for that which he has in abundance. We can "secure the blessings of liberty to ourselves and our posterity," if we will only heed the laws of human conduct as we engineers heed the laws of the physical world.

ASME TECHNICAL DIGEST

Substance in Brief of Papers Presented at ASME Meetings

Steam Power Generation

High-Temperature Properties and Characteristics of a Ferritic Steam-Piping Steel, by A. W. Rankin, Mem. ASME, and W. A. Reich, General Electric Company, Schenectady, N. Y. 1950 ASME Annual Meeting paper No. **50—A-76** (mimeographed).

CURRENT maximum steam-temperature levels of 1000 and 1050 F push the more common ferritic steels, with their customary heat-treatments, to a point where heavy walls are required to maintain satisfactory margins on the creep and rupture strengths. Although austenitic steels may be used, material costs increase and fabricating and operating difficulties peculiar to the metallurgy of these steels may arise. Much is to be gained, therefore, if a stronger ferritic steel can be found for turbine shells, steam leads, and station piping.

Molybdenum-vanadium steam leads have been in service at 950 F and 1000 F since 1948 and, in general, have performed satisfactorily with respect to fabrication, welding, and service operation. There was one service failure at the Industrial Canal Station of the New Orleans Public Service, Inc., but it has been established that a crack almost completely through the turbine lead existed prior to fabrication, as noted in a companion paper (50—A-75) by the same authors.

Report on Split Steam Lead at New Orleans, by A. W. Rankin, Mem. ASME, and W. A. Reich, General Electric Company, Schenectady, N. Y. 1950 ASME Annual Meeting paper No. **50—A-75** (mimeographed).

THIS report is based on a failure at the Industrial Canal Station of New Orleans Public Service, Inc., on June 16, 1949. The piping had been in service for approximately nine months, turbine throttle conditions being 1250 psig, 950 F. One end of the split was at a weld between the steam lead and a small forged stub intermediate between the stop valve and the steam lead, and the other end was approximately 30 in. downstream in the steam lead. There was no weld or detectable change in material or wall thickness at this latter end of the split.

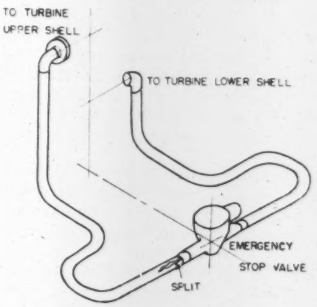
The split section of the steam lead was cut out and returned to the manufacturer for an investigation of the cause of failure. The following procedures were carried out: X-ray and magnetic particle test, dimensional checks, physical tests, chemical analysis, macroscopic examination, microscopic examination, study of weld x-ray films. From the investigation the following major conclusions were established:

1 The subject pipe was cracked to within approximately $^1/_8$ in. of the outside surface prior to being placed in service.

2 The remaining approximately $^1/_8$ in. of wall failed either by rupture as a result of the long time at the service temperature of this installation, or by a longitudinal tear initiated by such a long-time rupture in service at a particular point of the remaining wall.

3 The initial and major portion of this fracture, which is the inner $^5/_8$ in. of wall for the entire length of the split, took place at a relatively low temperature, and is a cleavage fracture characteristic of a failure below the charpy transition temperature of a material.

4 The cleavage fracture was produced sometime between removal of the pipe from the cooling table in the pipe manufacturer's shop and the start of processing in the pipe fabricator's shop. During this latter processing, the fracture surfaces were oxidized when the pipe was heat-treated to produce the desired high-



LOCATION OF SPLIT IN STEAM LEAD

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temperature properties. It is the opinion of the authors that the most likely point at which this cleavage failure was produced was during the cold straightening operations prior to the final cropping of the pipe, although definite evidence to substantiate this opinion is unavailable.

Power-Plant Operation With Hot Lime-Zeolite Process, by L. F. Wirth, National Aluminate Corporation, Chicago, Ill., and W. S. Butler, The Dow Chemical Company, Ludington, Mich. 1950 ASME Annual Meeting paper No. **50—A-77** (mimeographed).

THIS paper describes pretreatment by this means of boiler make-up for maximum hardness, silica, and bicarbonate reduction.

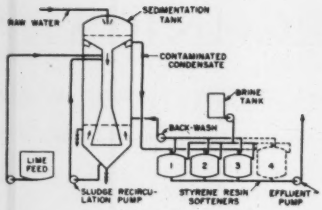
With make-up taken from the Pere Marquette River, the Ludington Plant of the Dow Chemical Company, containing two 225,000-lb per hr, 425-psi boilers, had originally employed the hot lime-soda-phosphate system at an operating temperature of 230 F. Subsequent changes in the plant product requiring the direct usage of 40,000 to 50,000 lb of steam per hr in process brought the make-up requirements beyond the capacity of the existing softening system, and consideration had to be given to selection of a new system.

Decision was in favor of trying hot styrene-type resinous-exchange material, which recent pilot-plant studies had shown to be applicable to secondary softening following the hot-lime-soda process. This was tried for a period of 41 days and resulted in total hardness reduction from 167 ppm as $CaCO_3$ in the raw water to 1.8 ppm in the secondary effluent, but silica reduction was negligible and the average CO_2 content of the steam was 5 ppm. Turbidity of the primary softener effluent averaged 40 ppm as SiO_2.

Next it was decided to determine the effect of the addition of sodium aluminate to the primary softener, followed by the hot styrene resin exchange. This had the effect of further reducing the final total hardness to 0.6 ppm, the silica to 0.8 ppm, and the turbidity to 4 ppm, as SiO_2. The CO_2 in the steam averaged 5 ppm.

This combination was then modified by incorporating a sludge blanket and recirculation of 5 per cent of the sludge with the result that turbidity of the effluent of the primary softener was reduced to 2 ppm and the carbon dioxide in the steam to 3 ppm.

Finally, the primary treatment was changed to hot lime-sodium aluminate, with sludge blanket, followed by the hot styrene resin exchange. The results



TWO-STAGE HOT-PROCESS SYSTEM SEDIMENTATION PLUS ION-EXCHANGE

of 51 days operation gave an average total hardness reduction from 167 ppm as $CaCO_3$ in the primary influent to 0.5 ppm in the secondary effluent, of which 0.1 ppm was magnesium; silica reduction from 3 ppm to 0.5 ppm; turbidity averaged 0.7 ppm; and CO_2 in the boiler steam 1 ppm.

It was concluded that:

1 Hardness of the secondary softener effluent of a hot lime-aluminate-styrene resin softener can be reduced to 0.4 ppm, of which 0.1 ppm is magnesium.

2 With sludge recirculation, silica can be reduced to 0.3 ppm as SiO_2.

3 Sodium aluminate fed together with the lime results in turbidity of 1 ppm or less in the influent to the secondary softener.

4 When lime and sodium aluminate alone are used for the primary treatment, the CO_2 content of the steam can be maintained at 1 ppm, which should be helpful in eliminating magnetic-iron-oxide deposits.

Fireside Deposits on Steam Generators Minimized Through Humidification of Combustion Air, by Paul Murphy, Jr., Jun. ASME, John D. Piper, and Chester R. Schmansky, The Detroit Edison Company, Detroit, Mich. 1950 ASME Annual Meeting paper No. **50—A-86** (mimeographed; to be published in Trans. ASME).

THE work reported in this paper is said to be the first instance in which combustion air has been humidified for the specific purpose of reducing the formation of high-temperature deposits in large stoker-fired steam generators and for which proof is given that humidification accomplishes that purpose.

Chemical analyses of deposits removed early in 1949 from the superheaters of stoker-fired units at the Delray Station showed that these deposits could be classified as being of the alkali-matrix type. It has been reported that sodium, potassium, and lithium compounds volatalize or are carried in flames from the fuel bed and condense upon cooler surfaces, where they react with sulphur trioxide to form sticky semifluid sulphates, bisulphates, and pyrosulphates. After reviewing theories concerning the formation of alkali-matrix deposits, a decision was made to investigate the possibility of eliminating the volatilization of sodium and potassium compounds. One procedure is to add a reactant that will render the product less volatile than the original material; by adding moisture and endothermic water-gas reaction may take place in the fuel bed. The heat thus absorbed should be recoverable when the products of the reaction burn.

For many years it had been known that superheater deposits formed more rapidly in winter than in summer at the Delray Station. The amount of water vapor per hour entering the fuel bed with combustion air was computed from U. S. Weather Bureau data for 1948 and 1949, and it was found that there was striking correlation, especially for the latter year, with periods of high humidity coinciding with periods of low stack-gas temperature and high efficiency. Therefore it was decided to make a test run in which a total input of 7000 lb per hr of moisture was introduced for a steaming rate of 325,000 lb per hr, or 16.4 lb of moisture per 1000 lb dry air. Flexible control was provided so that the amount of moisture, which was added as saturated steam, could be adjusted each hour to compensate for changes in the absolute humidity of the outdoor air. Before the test began on Dec. 3, 1949, the external heating surfaces were given a routine scraping and alkali-water washing, and the economizer and air-heater surfaces were fairly well cleaned, although the less accessible superheater surfaces held the usual residual blue-gray deposits.

A test was run for 133 days with humidification. During this period the stack gas temperature increased but 10 F, while the boiler-outlet gas temperature rose approximately 50 F in the first 60 days of operation and then remained essentially constant. Throughout this period the steam generator was capable of steaming 400,000 lb per hr, and it was observed that there was less deposit on the front rows of superheater tubes than would have been the case in 30 to 50 days without humidification. The economizer was remarkably clean; the water walls and boiler tubes remained free of white deposits which normally accumulate; the air heater was in the same condition at the end of the 133-day test as is generally found after 30 to 50 days without humidification.

According to information available to

date, the humidification requirements will average 1.3 per cent annually, with a peak of 2 per cent during the coldest part of the winter. With what is already known concerning humidification it would appear that this method, by keeping heating surfaces cleaner, will improve average efficiency at least enough to compensate for the cost of its use, thereby leaving a distinct gain through better availability and lower maintenance.

Basic Study for a Generating Station, by G. R. Milne, Mem. ASME, Consolidated Edison Company of New York, Inc., New York, N. Y. 1950 ASME Annual Meeting paper No. **50—A-87** (mimeographed; to be published in Trans. ASME).

THE results of cost studies made to determine the most economical size and type of boiler and turbine-generator for a new station of the Consolidated Edison system are given. The following are some of the assumptions that were made:

1 Feedwater temperature of 450 F.

2 Six stages of feedwater heating. (A supplementary study was made comparing the economy of five, six, seven, and eight stages; also a comparison of the cost of a single boiler feed pump versus that of a combination of booster pumps ahead of the boiler feed pump.)

3 1-in. Hg back pressure with 45 F circulating water.

4 Motor-driven auxiliaries used throughout.

5 Auxiliary power requirements assumed at 7 per cent of gross output.

6 Study limited to maximum steam temperature of 1050 F.

7 Fuel cost of 40 cents per million Btu.

8 Initial annual loading of 5000 hr at full load; 1500 hr at $^3/_4$ load and 1000 hr at $^1/_2$ load.

In comparing units of 80, 110, and 160-mw maximum capability it was found that the 160-mw units held an economic advantage. Similarly, the single-boiler arrangement showed a favorable cost differential ranging from $3^1/_2$ to $7^1/_2$ per cent by comparison to two boilers per unit. Based on a single-boiler-per-turbine arrangement, a cross-compound unit was found to be more economical than a tandem compound, and in addition the former had a quadruple exhaust which provides a higher overload capacity. The most economical nonreheat cycle evaluated was found to be 1450 psig, 1050 F, while the most economical reheat cycle, 1800 psig, 1000 F, 1000 F, had an evaluated cost $4^1/_2$ per cent under the nonreheat cycle just noted. The arrangement finally selected was a 160 megawatt 3600/3600 rpm cross-compound unit with a single boiler per turbine operating on the reheat cycle at 1800 psig, 1000 F, 1000 F.

An investigation was also made to determine the number of feedwater heaters. Based on fuel at 40 cents per million Btu and 6 deg F terminal difference in closed heaters, the cycle using seven stages of heating with closed heaters both above and below the deaerator is justified. The cycle selected had a theoretical net heat rate of 9335 Btu per kwhr, excluding certain losses, and an actual net station heat rate approximating 9700 Btu per kwhr.

Boiler Feedwater Studies

The Solubility of Quartz and Some Other Substances in Superheated Steam at High Pressures, by G. W. Morey and J. M. Hesselgesser, Carnegie Institution of Washington, Washington, D. C. 1950 ASME Annual Meeting paper No. **50—A-73** (mimeographed; to be published in Trans. ASME).

AN apparatus and method for determining the solubility of silica in superheated steam at high pressures are described. At 752 F, the solubility of quartz in steam increases from 3.1 parts per million at 1000 psi to 1548 parts per million at 15,000 psi; at 932 F, the solubility increases from 14.2 parts per million at 1000 psi to 2596 parts per million at 15,000 psi. The curves representing the solubility results at 752 F and 932 F cross at two pressures. Between these two pressures the solubility is greater at 752 F than at 932 F; below and above these pressures the solubility is greater at 932 F than at 752 F. This crossing is ascribed to the pressure-density relationships of water at the two pressures, which are affected by the proximity at 752 F of the critical point of water. When the solubility is plotted against the density of steam at each measured point, the curves do not cross, and the solubility at 932 F is greater than at 752 F.

The solubilities of some other substances in superheated steam at high pressures are also given.

The Prevention of Embrittlement Cracking, by A. A. Berk, Bureau of Mines, College Park, Md. 1950 ASME Annual Meeting paper No. **50—A-84** (mimeographed; to be published in Trans. ASME).

SOME 25 years ago intercrystalline cracking of boiler steel, as caused by the building up of concentrated caustic in contact with stressed metal, was thought to be inhibitable by maintaining a definite sulphate-alkalinity ratio in the boiler water. Therefore these recommended ratios were incorporated in the ASME Boiler Code in 1926. Subsequently, however, it was demonstrated that such treatment was uncertain, particularly at higher pressures; but research pointed to the effectiveness of tannin, lignin, and sodium nitrate.

In this connection, an embrittlement detector was developed. This detector was widely described at the time and has since been in use at many utility and industrial power plants. In brief, it is a device attached to a boiler in such a way that partial evaporation and concentration of the boiler water takes place on the stressed surface of a test specimen which forms part of an especially designed seam.

Results of some 2000 tests obtained with 600 detectors in 500 boiler plants as reported during 1949, as well as 500 tests on locomotive boilers have been summarized for this paper. The results showed the effectiveness of sodium nitrate, tannin, and zero-caustic treatments. Nitrate and quebracho are inhibitors of intercrystalline corrosion in hot concentrated caustic solutions; and the zero-caustic treatment (also called the "co-ordinated phosphate" or "captive alkalinity" method) prevents the formation of concentrated solutions of caustic.

Because of the interest in the sulphate-alkalinity ratios, data for pressures to 250 psi were re-examined. In 57 tests where the recommended sulphate-carbonate ratios were satisfied, caustic soda was present and nitrate or tannin was not present in significant amounts. Cracking resulted in 39 of these tests which corresponded approximately to the frequency of failure in the group of tests representing no treatment. In contrast, there were no failures where the concentration of free caustic was zero, fewer than one per cent where the water was treated with nitrate, and fewer than 8 per cent where quebracho or tannin treatment was used.

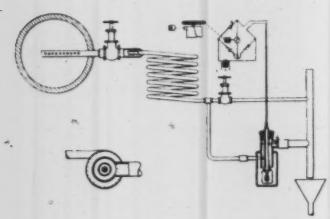
Twenty-six cases of cracking of stationary boilers had been investigated by the author during the period 1942–1949; of these, 24 were definitely due to embrittlement. In six of the plants the boiler drums were welded and in the others riveted. Cracks were found in butt straps, drum metal, tube seats, and tube ligaments. In no instance was nitrate or a tannin-type inhibitor present in concentrations shown by embrittle-

ment-detector tests sufficient to prevent cracking. The effectiveness of the sulphate-alkalinity ratios could not be accurately proved or disproved, however, inasmuch as none of the plants had complete data to show that the ratios had always been maintained. Nevertheless, five of these plants (four at pressures under 400 psi) maintained the prescribed ratios at the time of failure.

Simplified Process for Determining Steam Purity, by S. T. Powell, Fellow ASME, Consulting Engineer, Baltimore, Md., and I. G. McChesney, Jun. ASME, Rochester Gas & Electric Corporation, Rochester, N. Y. 1950 ASME Annual Meeting paper No. **50—A-85** (mimeographed; to be published in Trans. ASME).

THIS paper describes an apparatus that was developed to simplify the determination of dissolved solids in steam by electrical conductivity measurement while preventing contamination of the sample by gas or by impurities picked up in the sampling or testing apparatus. Because dissolved gases often combine chemically with the condensate it was necessary to take steps to prevent initial contamination of the condensate, as it is formed in the sampling and measuring system. This is accomplished by drawing off the steam at high velocity in such a manner that the exposed surfaces of the condensate particles are thoroughly scrubbed by steam passing through the sampling tube.

The apparatus is designed for use when sampling steam in a pressure range from somewhat above atmospheric to extremely high pressures and the discharge is at atmospheric pressure. It has been tested over a period of nearly two years and has been operated for a period of 18 months with only minor adjustments. Moreover, it is capable of recording solids in the steam well below one half part per million, the accuracy having been checked against meticulous evaporation of a number of large samples.

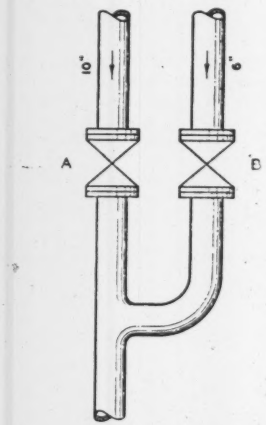


APPARATUS FOR MEASURING SPECIFIC CONDUCTIVITY OF HIGH-PRESSURE-STEAM SAMPLES

Properties of Metals

Experience With Austenitic Steels in High-Temperature Service in Petroleum Industry, by M. E. Holmberg, Phillips Petroleum Company, Bartlesville, Okla. 1950 ASME Annual Meeting paper No. **50—A-41** (in type; to be published in Trans. ASME).

HIGH temperatures and high pressures, for many years were associated with improvements in refining processes. In many cases maximum improvement was impossible because suitable steels were not available to withstand the ever-higher temperatures and pressures. The refineries demanded better high-temperature steels and were quick to use the new alloys developed by the steel industry. It is not surprising, therefore, that the oil industry has a wealth of experience in the use of materials in high-temperature service.



PIPING ASSEMBLY IN WHICH CRACKS DEVELOPED IN AUSTENITIC VALVES IN 10 DAYS, BUT NOT IN FERRITIC PIPING AND FLANGES

(Valves alternately opened and closed in 8-hr cycle. Temperature of fluid was approximately 1130 F.)

The most severe high-temperature service has been in still tubes, gas-cracking furnaces, and associated piping. Fluid temperatures of 1350 F have not been uncommon. Pressures as high as 5000 psi have been used. Metal temperatures of 1450 F are common. Due to the formation of coke on the inside of tubes, much higher temperatures frequently are encountered unintentionally. Cyclic operations, involving periodic changes in temperatures, have increased the severity of conditions.

This paper is devoted mostly to the austenitic steels because of the recent interest of many in the use of these steels for high-temperature service. Reference is also made to the ferritic steels, which for many purposes have definite advantages. The purpose of the paper is to call attention to factors that should be considered in using austenitic steels in high-temperature service. It is based on performance of materials in service and examinations of material removed from service.

The paper concludes that: (1) Stabilized austenitic steels are not required for gas-cracking and still tubes; (2) a spheroidizing heat-treatment is adequate for many oil-industry applications requiring austenitic steels in the stabilized condition; (3) stress-relieving austenitic steels can seldom be justified, unless stress-corrosion cracking is known to occur; (4) the hot-short characteristics of austenitic steels should be considered in high-temperature design; (5) the low thermal conductivity and high coefficient of expansion are responsible for many of the failures of austenitic steels in high-temperature service, especially where thermal shock and thermal fatigue are involved.

Nickel-Chromium-Molybdenum Steel Valve Casting After 50,000 Hr of Service at 900 F, by T. N. Armstrong and R. J. Greene, The International Nickel Company, Inc., New York, N. Y. 1950 ASME Annual Meeting paper No. **50—A-67** (in type; to be published in Trans. ASME).

EXTENSIVE tests have indicated that nickel-chromium-molybdenum steel, conforming to the requirements of ASTM Specifications A-217, is very resistant to graphitization under conditions imposed in the laboratory in testing cast valves and fittings of this composition for steam temperatures up to 950 F. Through the co-operation of The Detroit Edison Company, a cast-steel valve of approximately WC-4 composition that had been in service over 6 years was made available for study. The paper describes tests made on this valve and the results obtained.

The General Tensional Relaxation Properties of a Bolting Steel, by D. N. Frey, University of Michigan, Ann Arbor, Mich. 1950 ASME Annual Meeting paper **50—A-68** (in type; to be published in Trans. ASME).

ONE objective of the investigation reported in this paper was to measure

the tensional relaxation properties of a Cr-Mo-Si-Va commercial high-temperature bolting at 1000 F under varying conditions of follow-up by means of the step-down relaxation test. To this end certain necessary assumptions were made relative to high-temperature behavior, which were checked for validity by means of a true relaxation test, with a particular value of elastic follow-up, carried out in a Barr and Bardgett test unit. Comparison of these results with the results of the step-down test at the same value of elastic follow-up gives a partial evaluation of the assumptions inherent in the latter testing method.

An Introduction to Arc-Cast Molybdenum and Its Alloys, by J. L. Ham, Climax Molybdenum Company of Michigan, Detroit, Mich. 1950 ASME Annual Meeting paper No. **50—A-70** (in type; to be published in Trans. ASME).

THE advantages and limitations of the arc-casting method for producing metallic molybdenum and its alloys are discussed. The general properties of unalloyed cast molybdenum are described and curves are presented to show the room-temperature tensile properties, hardness, and notched-bar values after annealing at various temperatures, the effect of testing temperature on hardness, and the transition temperatures for various types of impact tests.

The need for addition of alloying elements is discussed. Preliminary selection of appropriate alloying elements was based on their vapor pressures and known or expected solid solubility limits. Curves are presented showing the solid solubility limits of silicon, aluminum, iron, cobalt, and nickel in molybdenum at various temperatures as determined by the measurement of lattice parameters of arc-cast samples, and the effects of beryllium, aluminum, silicon, titanium, vanadium, chromium, iron, cobalt, nickel, zirconium, columbium, tantalum, and tungsten on the hardness of molybdenum at various temperatures.

Molybdenum containing a small amount of beryllium can be hardened by quenching and softened by slow cooling.

Regardless of which alloying element is used, there appears to be a limit to the increase in hardness that can be tolerated without causing difficulty in hot-working by the techniques applied so far.

The effects of several of the alloying elements on the rate of work hardening and on the temperatures of softening and recrystallization were studied using a series of alloys which were extruded.

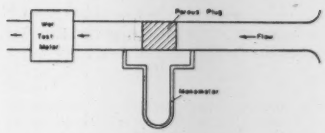
An Investigation of the Role of Aluminum in the Graphitization of Plain-Carbon Steel, by A. M. Hall and E. E. Fletcher, Battelle Memorial Institute, Columbus, Ohio. 1950 ASME Annual Meeting paper No. **50—A-69** (in type; to be published in Trans. ASME).

THIS investigation was sponsored by Project No. 29 of the joint ASTM-ASME Committee on the Effect of Temperature on Properties of Metals, and was directed toward casting more light on the role of aluminum in the breakdown of iron carbide in plain-carbon steels into iron and graphite at temperatures below the lower critical point of the steel. The approach to the problem was to extract the carbides from several plain-carbon steels which had been deoxidized with different amounts of aluminum and had different known degrees of susceptibility to graphitization, and then to examine and analyze the extracted carbides, with particular attention to the amount and form of the aluminum therein. By comparing the aluminum found in the carbide with the aluminum of the original steel, data were obtained on the role which that element appears to play on the graphitization process. The results strongly suggest that a graphitization-resistant, plain-carbon steel does not differ fundamentally from one which graphitizes readily. It is tentatively concluded that in order to promote graphitization, the aluminum is either in solid solution in the ferrite matrix, or else fixes the nitrogen as AlN. Which of these forms it takes could not be determined from the results. The results further suggested that any aluminum which might be associated with the carbide phase is not influential in determining the degree of susceptibility to graphite formation.

Fluid Meters

Study of Linear-Resistance Flowmeters, by F. W. Fleming and R. C. Binder, Mem. ASME, Purdue University, West Lafayette, Ind. 1950 ASME Annual Meeting paper No. **50—A-37** (in type; to be published in Trans. ASME).

A LINEAR or linear-resistance type of flowmeter can consist of a straight piece of pipe with a porous plug, or a resistance element, and a differential gage across the porous plug. In a certain flow range the volume rate of flow through the meter is directly proportional to the pressure drop across the plug. An investigation was made of linear flowmeters with cotton and steel-wool plug elements. The tests covered a range of pipe sizes, plug lengths, and plug specific weights. Typical characteristic curves are presented. A set of dimensionless ratios is proposed for a correlation of all the data for general application.



SCHEMATIC DIAGRAM OF APPARATUS

Orifice Meters With Supercritical Compressible Flow, by R. G. Cunningham, The Pure Oil Company, Chicago, Ill. 1950 ASME Annual Meeting paper No. **50—A-45** (in type; to be published in Trans. ASME).

THE discharge characteristics of orifices at low pressure ratios were investigated. Probe measurement of high-velocity jets confirm and extend the work of Stanton. Expansion factors (Y) at pressure ratios down to $r = 0.13$ were measured for the flow of air in a 2-in. pipe meter and for the flow of steam in a 3-in. pipe meter. Both meters were installed in accordance with ASME specifications, and operated at a diameter ratio of 0.15. The effects of high approach velocity on the discharge characteristics of square-edged orifices at low pressure ratios were investigated; expansion factors were determined for diameter ratios from 0.2 to 0.8 over a range of pressure ratios from unity to 0.2. A linear $Y - r$ correlation is shown to exist at low pressure ratios; a change of flow regime occurs at a pressure ratio of 0.63. A theoretical solution for supercritical flow, previously established by the author, is further compared with experimental results.

Discharge Coefficients of Small-Diameter Orifices and Flow Nozzles, by H. P. Grace and C. E. Lapple, E. I. du Pont de Nemours & Company, Wilmington, Del. 1950 ASME Annual Meeting paper No. **50—A-64** (in type; to be published in Trans. ASME).

DISCHARGE coefficients were determined in a standard 1-in. pipe for thick-plate and knife-edge orifices of $^1/_{32}$-in. to $^3/_4$-in. diam, and for critical (sonic) flow nozzles of $^1/_{32}$-in. to $^1/_4$-in diam. With properly constructed knife-edge orifices the discharge coefficients were established within ±0.5 per cent for all sizes, but, with small orifices of $^1/_4$ to 1-hole-diam thickness, the discharge coefficients were not reproducible. Thick-plate orifices (1-hole-diam thick) were found

to be as good or better than nozzles in constancy of discharge coefficients when used under critical-flow conditions.

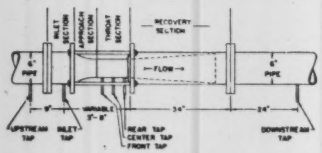
Discharge Measurements by Means of Venturi Tubes, by A. L. Jorissen, Mem. ASME, The Pennsylvania State College, State College, Pa. 1950 ASME Annual Meeting paper No. **50—A-71** (in type; to be published in Trans. ASME).

AN attempt is made to present a comprehensive idea of the actual stage of development of the method of flow measurement by means of Venturi tubes. Use has been made here of (*a*) the latest available American and European Standards, published by the various national associations: The American Society of Mechanical Engineers, 1937; Ente nazionale per l'Unificazione nell' Industria, 1938; British Standards Institution, 1943; Verein deutscher Ingenieure, 1948; Association francaise de Normalisation, 1949. (*b*) The decisions taken at the international meetings of the Committees on Flow Measurement: ISA 30, Helsinki, 1939; ISP 30, Paris, 1948. (*c*) Published research reports. Both the nozzle-type and the Herschel-type Venturi are discussed from the viewpoints of discharge coefficient and pressure losses. The conclusions point out the need of further research and the necessity of an international standardization.

A Study of Head Loss in Venturi-Meter Diffuser Sections, by Joel Warren, Jun. ASME, Brown University, Providence, R. I. 1950 ASME Annual Meeting paper No. **50—A-65** (in type; to be published in Trans. ASME).

THERE has been considerable experimental and analytical work done, pertaining to diffuser action, both in this country and abroad. The research discussed in this paper was undertaken to furnish additional information with reference to the relative performance of various shapes of diffuser sections in Venturi tubes.

Data presented in the paper indicate that the minimum per cent head loss for recovery cones in Venturi meters installed in 6-in. pipe lines depends upon both the cone angle and the ratio of cone entrance diameter to exit diameter (β). Concerning per cent head loss, cones with a small value of (β) seem to be quite sensitive to cone-angle change, whereas the per cent head loss changes a relatively small amount in cones with a large value of (β) as the cone angle is changed. In certain instances, shortening of recovery cones by cutting off small portions at the large end resulted in decreased per cent head loss when compared with full-length cones of the same angle.



VENTURI TEST RIG

Furnace Performance Factors

THE third phase of the investigations of the Special Research Committee on Furnace Performance Factors dealing with furnace heat absorption when burning pulverized coal was reported in two parts. These reports are based on a series of thirteen tests made in June, 1949, on a single-drum B.&W. boiler rated at 500,000 lb of steam per hr at 1350 psig and 950 F at the superheater outlet. This unit, which is located at the Willow Island Station of the Monongahela Power Company, Willow Island, W. Va., has a water-cooled dry-bottom furnace that is fired through the roof with six multitip intertube burners. The tests were made to determine the effect on furnace heat absorption of variations in load, excess air, and arrangement of burners in service.

Furnace Heat Absorption in Pulverized-Coal-Fired Steam Generator, Willow Island Station, Part I: Furnace Heat Absorption Efficiency as Shown by Temperature and Composition of Gases Leaving the Furnace, by James W. Myers and Richard C. Corey, Mem. ASME, Bureau of Mines, Pittsburgh, Pa. 1950 ASME Annual Meeting paper No. **50—A-83** (mimeographed; to be published in Trans. ASME).

THE furnace heat absorption was determined as the difference between the net heat input and the heat losses comprising the sensible heat in the products of combustion and radiation and convection losses from the furnace casing. During the thirteen tests the gas temperature at the furnace outlet varied considerably with position. Generally, the highest temperature occurred on the right side of the furnace outlet and the lowest on the left when symmetrical burners were in operation. With other burner arrangements, the maximum temperature occurred between the center and left side, and the minimum usually was found between the center and right side. In several tests, particularly those with all burners in service, very low temperatures were observed near the division wall, which was ascribed to low gas velocities or eddy currents. Disregarding these low points, the spread in the temperature of exit gases varied from 200 to 460 F. It was concluded that the temperature distribution patterns have a complex relationship with distribution of fuel and air to the burners, the velocity and path of the gas between the burners and the furnace outlet, and the location and extent of ash deposits on the walls.

Good agreement was noted, except for one test, between the furnace heat absorption calculated from heat-balance data and the heat required for generation of steam. Approximately 90 per cent of the evaporation occurs within the furnace, excluding the screen. The maximum corrected furnace heat-absorption efficiency was 56.6 per cent at half load, when operating with two mills and 24 per cent excess air. The lowest efficiency, 42.4 per cent, was obtained at full load with 24 per cent excess air and with all burners in service. The furnace heat-absorption efficiency decreased with an increase of excess air in all cases, the decrease being more pronounced at higher loads. Although the evidence is not entirely conclusive, it would appear that the effect of excess air on the heat-absorption efficiency is independent of the location of burners in operation. With all other conditions held constant, the heat-absorption efficiency decreased with increased values of net heat available.

The study shows the feasibility of a relatively simple correlation of furnace heat absorption with the temperature of the gases at the furnace outlet. Although this correlation may be used to evaluate the effect of such factors as flame area and emissivity, it is an empirical treatment. There is a need to understand more fully how such fundamental variables as furnace geometry, firing method, burner location, and fuel and air distribution control the flame shape, ash deposits, and furnace-outlet temperature.

Part II: Variation in Heat Absorption as Shown by Measurement of Surface Temperature of Exposed Side of Furnace Tubes, by F. G. Ely and N. H. Twyman, The Babcock & Wilcox Company, Alliance, Ohio. 1950 ASME Annual Meeting paper No. **50—A-82** (mimeographed; to be published in Trans. ASME).

PART II is concerned with supplementary and independent measurements of furnace heat absorption obtained from special thermocouples installed in furnace wall tubes. Since the furnace comprises a major portion of steam generating surface and thereby serves to reduce the temperature of combustion products to acceptable values for entrance to the superheater, the proportioning of heat absorbing surface of the furnace and superheater becomes a critical design function. Deviations in the functioning of either of these components must be accounted for quantitatively and provision made for positive compensation in the daily operation of the unit.

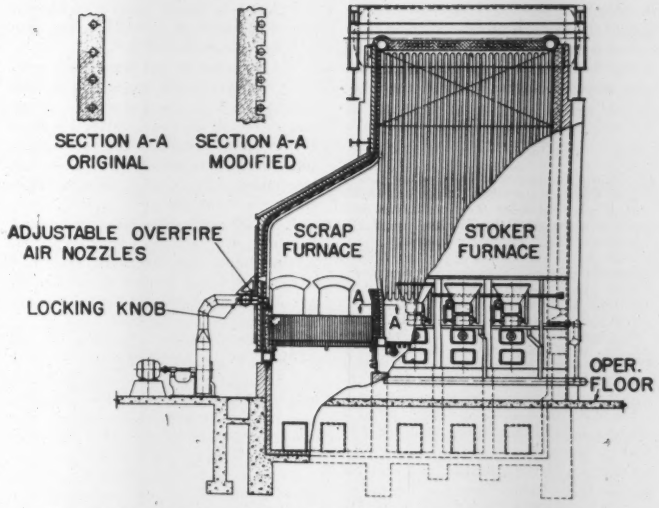
Supplementary tests were made using a sampling arrangement of special thermocouples installed in the furnace wall tubes in such a manner that the temperature drop through the tube metal could be evaluated, at least relatively, in terms of heat flux. A total of 124 furnace-wall-tube thermocouples were installed during the erection of the boiler and were connected by external lead wires to a Leeds & Northrup Speedomax Recorder equipped with a special selector switchbank which permitted scanning the entire group in approximately 24-min cycles. The pattern of placement was intended to provide a sampling which would measure and show the distribution of heat-absorption rate.

The tests disclosed that the effects of ash materially distort any simple comparison that might be drawn from their limited number. However, the following generalizations seem justified:

1 Increased load increases the maximum rate of heat absorption and markedly increases absorption of the ash-free lower portions of walls and hopper section.

2 The effect of increase or decrease in excess air is obscure but may similarly increase the proportion of heat absorbed in the lower part of the furnace.

3 Use of all burners transfers more duty to the upper part of the furnace, while the opposite effect is indicated for an unbalanced burner arrangement.



SECTIONAL FRONT ELEVATION SHOWING COMBINATION STOKER-REFUSE FURNACE

Fuels

Combination Spreader Stoker and Waste-Fuel Furnaces, by F. C. Messaros, Mem. ASME, American Engineering Company, Philadelphia, Pa. 1950 ASME Annual Meeting paper No. 50—A-63 (mimeographed).

THE Sloane-Blabon Corporation, Philadelphia, Pa., manufactures felt-base floor covering from which there is much scrap in the form of large sheets and strips. For many years these presented a disposal problem. Periodically the scrap was hauled to a dump and at other times it was burned under a boiler.

The product contains about 50 per cent wood pulp, 14 per cent rag stock, and 36 per cent newsprint, the mixture heavily impregnated with asphalt. The volatile runs very high and the heating value ranges from 12,000 to 14,000 Btu per lb.

Present methods of burning by means of a two-stage furnace in combination with coal are described in this paper.

The boiler is of the two-drum, bent-tube type and has a primary furnace for burning the scrap and a secondary furnace to which coal is fired by means of a three-unit spreader stoker. The coal-burning furnace is completely water-cooled, but the scrap furnace has water cooling only on the side wall and roof with refractory walls at front and rear. A 4-ft refractory and water-cooled curtain wall provides partial separation of the two furnaces.

Scrap is charged manually into the primary furnace, but coal is fed to the spreader units by a conveyer. Attempts to hog the scrap were abandoned because of the many bolts, nuts, etc., present.

To provide the necessary turbulence ten overfire air nozzles are located in the side wall above the grate of the primary furnace. These employ 300-F air.

The unit is equipped with a cinder and fly-ash collecting system.

Review of Air-Pollution Prevention in the United States, by J. F. Barkley, Mem. ASME, Bureau of Mines, Washington 25, D. C. 1950 ASME Annual Meeting paper No. 50—A-126 (mimeographed; to be published in MECHANICAL ENGINEERING).

THE history of smoke-abatement ordinances are reviewed dating back to 1876 in St. Louis, followed by Chicago in 1881, and widespread legislation in many cities about the turn of the century, with subsequent attention being directed to the general subject of atmospheric pollution from all sources.

The difficulties are as follows:

After about a century of city air-pollution-prevention problems in this country, half of which has included considerable activity, the question naturally arises as to why better progress has not been made. Similar problems have been solved essentially in so far as contaminants in city water, milk, food, and drugs are concerned.

Various reasons have been advanced as to why air-pollution interest has waxed and waned. City politics, lack of funds, organizational difficulties, the general bigness of the problem, the countless sources and points of production of contaminants, the economic impossibilities of stopping the emission of contaminants, and lack of continued public interest all have been cited with good justification. Campaigns started by public-spirited men, women, and organizations can always entrain followers for a time, but a campaign can last only so long, and the followers become interested

in something else . . . . . It is up to members of the medical profession to do their part toward better living by establishing needed facts about city air pollution that will impress themselves and then the general public.

Problems Encountered in Burning Heavy Fuel Oil as Related to Attack of Metals at High and Low Temperatures and the Fouling of Tube Banks, by E. F. Tibbetts, The Lummus Company, New York, N. Y.; O. L. Wood, Jr., Jun. ASME, General Electric Company, Schenectady, N. Y.; D. Douglass, Mem. ASME, Hartford Electric Light Company, Hartford, Conn.; and V. F. Estcourt, Mem. ASME, Pacific Gas and Electric Company, San Francisco, Calif. 1950 ASME Annual Meeting paper No. 50—A-136 (mimeographed; out of stock at press time).

IN view of the many cases reported of slagging and corrosion encountered in boilers firing heavy residual fuel oils, particularly those containing appreciable percentages of vanadium, the Petroleum and Chemical Panel of the Joint ASME-ASTM Committee on Effect of Temperature on Properties of Metals undertook a comprehensive survey of the subject. This included a large number of petroleum companies and those power-generating stations known to be burning such oil, as well as major equipment manufacturers. The numerous replies and an analysis of the findings are presented in this paper.

The evidence submitted, while noting many difficulties with slagging and corrosion at elevated temperatures, nevertheless indicated that the majority of fuel-oil consumers are not encountering serious difficulties, regardless of whether domestic or foreign oil is being burned. It is believed that although high-vanadium-oil ashes are the most troublesome, residual oils containing vanadium can be burned in most installations without difficulty if precautions are taken to assure good combustion conditions, through proper heating and atomization and if the metal temperatures are kept below the melting temperature of the ash.

The following points were emphasized as having important bearing:

1 Vanadium pentoxide itself is extremely corrosive in the molten state and is sufficiently volatile to be corrosive in the vapor state; but its principal effect is believed to be that it lowers the melting point of the already corrosive alkali sulphate ash.

2 Vanadium oxide is an active catalyst which is employed in the manufacture of sulphuric acid, and the assumption is that it catalyzes the formation of SO_3 from SO_2 which, in turn, will combine with solid or volatile sodium salts to form sodium sulphate.

3 Corrosion is attributed to vanadium-sulphate attack on protective oxide coatings of heat-resistant steels. In one case in which the V_2O_5 comprises about 29 per cent of the ash, the corrosion of superheater supports and spacer bars was severe, but there was very little attack on the tubes.

4 It is suggested that where temperatures are high and design does not permit radiant heating only, such as is the case in a gas turbine or where tube spacing cannot be increased, as in marine boilers, the only complete solution is the use of an additive to produce an ash having a higher melting point

5 Marine boilers have been known to slag more quickly when the fuel has been contaminated with sea water with resultant sodium in the ash. However, such slag is largely water-soluble.

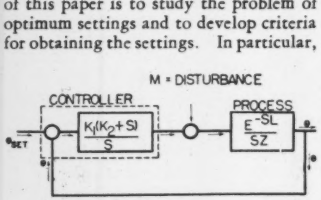
6 The committee offers the opinion that, although certain residual oils are more troublesome in critical applications, the consumption of these fuels in non-critical applications will continue to greatly exceed that of the critical applications. Hence it would be uneconomic for the oil refiner to attempt to change present practices where residual oils, as marketed, are blends of refinery runs of mixed crude charge stocks. Therefore it is believed that it would be a serious mistake for a consumer to assume that such fuels can be supplied to specifications that restrict the source of crude to the refinery or to require special handling and storage.

Finally, if a simple conclusion can be drawn, it is that oil-fired furnaces and boilers must be designed with a full understanding of the problems involved, that the flow of flue gases containing oil ash must avoid, in so far as possible, contact with metal surfaces, and that all fuel oil must be atomized as completely as possible at all times with combustion completed at the burner and no flame impingement on any metal surface. Cold end condensate corrosion can be avoided only by maintaining metal temperatures above the dew point of furnace gases and higher stack temperatures or recirculation of air in preheaters must be used if corrosion is encountered. The presence of higher percentages of vanadium in oil-ash deposits will definitely catalyze the formation of sulphur trioxide which will in turn raise dew-point temperature and thus initiate corrosion in furnaces where corrosion has not been encountered when low-vanadium oils are fired.

Industrial Instruments

Controller Settings for Optimum Control, by W. A. Wolfe, University of British Columbia, Vancouver, B. C. 1950 ASME Annual Meeting paper No. 50—A-22 (in type; to be published in Trans. ASME).

WHEN a controller is applied to a process, one set of problems that arises is the dynamic action of the controller. Problems of speed of return, stability, and accuracy of control are all involved. In a paper by J. G. Ziegler and N. B. Nichols, a method of adjusting a controller was described. This method introduced and used concepts of time lag and reaction rate to arrive at satisfactory settings for the controller. The purpose of this paper is to study the problem of optimum settings and to develop criteria for obtaining the settings. In particular, the Laplace transform will be applied to an idealized plant and the resulting equations solved for optimum conditions.



BLOCK DIAGRAM SHOWING CONCENTRATION OF CONTROLLER AND PROCESS

Nondimensional Study of Proportional-Plus-Reset Control of a Single-Capacity System, by J. A. Hrones, Mem. ASME, and J. B. Reswick, Massachusetts Institute of Technology, Cambridge, Mass. 1950 ASME Annual Meeting paper No. 50—A-42 (in type; to be published in Trans. ASME).

MANY systems where the automatic regulation of one variable is an important problem may be considered single-capacity systems. In such systems the entire energy (nearly) stored can be expressed quantitatively in terms of a single variable. As the dynamic behavior of all linear single-capacity systems can be described by the same relationships, a nondimensional study of the regulation of such a system is applicable to all single-capacity systems. To give physical reality to the discussion this study is developed around the problem of the speed governing of a rotating disk in the presence of viscous damping.

Properties of Gases

A Summary of Viscosity and Heat-Conduction Data for He, A, H_2, O_2, N_2, CO, CO_2, H_2O and Air, by F. G. Keyes, Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass. 1950 ASME Annual Meeting paper No. **50—A-40** (in type; to be published in Trans. ASME. Out of stock at press time.)

THE available viscosity data in the literature have been collected, reduced to a uniform basis, and formulated by means of an empirical equation containing three constants. At very high temperatures, the equation approaches the form of the Sutherland formula. In the case of helium and argon, it was not found possible to represent the data over the whole temperature range of the available measurements with a single set of constants. Attention is called to the fact that the available viscosity data are in many instances known over a sufficiently long temperature range and with an accuracy which requires for its representation a more exact knowledge of the intermolecular field than can be obtained from the application in transport theory of a two-constant field representation. The question of the viscosity of mixtures is discussed briefly, and the use of a theoretical formula deduced by Enskog is illustrated by application to the binary mixtures, hydrogen-carbon dioxide, and hydrogen-propane. The formulation of the available heat-conductivity data for the substances listed in the title has been carried out using an equation of the same general form applied for viscosities. A table of formula constants for the substances is given.

Measurements of the Heat Conductivity of Nitrogen-Carbon Dioxide Mixtures, by F. G. Keyes, Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass. 1950 ASME Annual Meeting paper No. **50—A-38** (in type; to be published in Trans. ASME).

MEASUREMENTS have been made of the heat conductivity at 0, 50, and 150 C for three mixtures of nitrogen and carbon dioxide. At 50 C the conductivity of the pure compounds was measured over a range of pressure for constituents and mixtures. A discussion of the pressure effects is given, based upon a theoretical formula deduced by Enskog for pure gases, and it is found that to a good approximation the coefficients of p/T for the mixtures are a linear function of the composition. In the course of making the measurements on the mixtures a limit was observed of the pressures at which accurate results could be obtained. It is suggested in explanation of the phenomenon, that thermal diffusion causes a separation of the constituents in the temperature gradient of the apparatus. The conductivity cell employed was designed for measurements in the case of pure gases, to pressures far in excess of the pressures at which the effect was observed for the binary mixtures. The Enskog equation for the heat conductivity of binary mixtures at low pressure is applied to the heat-conductivity data for hydrogen-carbon dioxide at two temperatures and also to the new conductivity results for nitrogen-carbon dioxide mixtures. The comparison of observed and computed conductivities suggests the desirability of making new measurements on the hydrogen-carbon dioxide mixtures to determine whether or not the effect noted in making the new measurements has invalidated the older data.

Rubber and Plastics

Creep Properties of Lucite and Plexiglas for Tension, Compression, Bending, and Torsion, by Joseph Marin, Mem. ASME, Yoh-Han Pao, and George Cuff, The Pennsylvania State College, State College, Pa. 1950 ASME Annual Meeting paper No. **50—A-19** (in type; to be published in Trans. ASME).

IN this investigation, creep-time relations in tension, compression, bending, and torsion were obtained for lucite and plexiglas. For each type of stress the influence of the stress and time on the creep deformations and creep rates were determined. Various interpretations of the test data were made. It was found that there was a linear relation between the minimum constant creep rates and the stress when represented on a log-log plot. The creep deformations in tension and compression were expressed in terms of the stress and the time by an equation which considered the initial creep strain. A theory was developed for predicting the creep deflection and creep rate in bending, using the creep constants in tension and compression. Good agreement was found between the experimental and theoretical results.

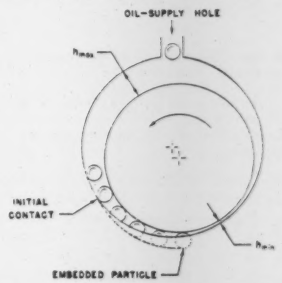
Strength Behavior of Adhesive Bonds, by H. P. Meissner, Massachusetts Institute of Technology, Cambridge, Mass., and G. H. Baldauf, Ecusta Paper Corporation, Pisgah Forest, N. C. 1950 ASME Annual Meeting paper No. **50—A-20** (in type; to be published in Trans. ASME).

PRACTICALLY all adhesive systems show an increase in strength with decreasing thickness of the adhesive layer. At least five different explanations for this "thickness-strength" rule have been proposed, based upon the following concepts: (*a*) Molecular orientation of the adhesive. (*b*) Differences in physical structure. (*c*) Theory of flaws. (*d*) Reduction of plastic flow during test. (*e*) Distribution of internal stresses. An investigation of these alternatives was made by testing butt joints between metal cylinders using eutectic solder, wax, and polystyrene as adhesives. Evidence indicating the correct explanation of the thickness-strength rule was obtained from a study of the effect on bond strength of bond geometry, from the location of bond failure, and from the relations between bond strength and bulk strength.

Lubrication

Performance of Oil-Film Bearings With Abrasive-Containing Lubricant, by A. E. Roach, General Motors Corporation, Detroit, Mich. 1950 ASME Annual Meeting paper No. **50—A-36** (in type; to be published in Trans. ASME).

THIS paper describes an experimental study of the embedability of bearing materials, i.e., the ability of bearing materials to operate on lubricants containing abrasive particles. It is found that the rate of temperature rise suffered by the bearing when abrasive-containing oil is introduced into it offers a convenient criterion for rating the embedability performance of various bearing materials. Data are presented on the effect of varying babbitt-overlay thickness and copper-lead composition, of gridded surfaces, and of oil grooves.



CROSS SECTION OF JOURNAL BEARING WITH EMBEDDED PARTICLE

The Effect of Oil Viscosity on the Power-Transmitting Capacity of Spur Gears, by V. N. Borsoff, J. B. Accinelli, and A. G. Cattaneo, Mem. ASME, Shell Development Company, Emeryville, Calif. 1950 ASME Annual Meeting paper **50—A-39** (in type; to be published in Trans. ASME).

IN tests made on spur gears with mineral oils of various viscosities, it was observed that a relationship exists between the maximum horsepower which the gears can transmit without scoring, and the product of gear speed and lubricant viscosity. An analysis of the factors entering into this relation indicates that these are the same that occur in the Lewis equation used in gear design, except that the latter does not contain the lubricant viscosity. If this viscosity is introduced into the Lewis equation, the latter represents the experimental points for horsepower transmitted at the onset of scoring very well over a wide range of speeds and lubricant viscosity. This modified Lewis equation appears to apply to spur gears, in general, and indicates that the influence of lubricant viscosity on the power-transmitting capacity of gears is much too great to be neglected in the design of gears.

Applied Mechanics

Velocity Distributions and Design Data for Ideal Incompressible Flow Through Cascades of Airfoils, by Robert Resnick, University of Pittsburgh, Pittsburgh, Pa., and L. J. Green, Case Institute of Technology, Cleveland, Ohio. 1950 ASME Annual Meeting paper No. **50—A-31** (in type; to be published in the *Journal of Applied Mechanics*).

THEORETICAL incompressible velocity distributions for three airfoils in various cascade arrangements and for different entering-air angles are presented. Design charts and design formulas relating cascade angle, entering-air angle, turning angle, and blade camber are presented for 10 per cent thick airfoils at solidity 1. An empirical turning-angle formula is developed and is found to be reasonably accurate and rather generally applicable.

Pressure Distribution in the Calendering of Plastic Materials, by J. T. Bergen and G. W. Scott, Jr., Armstrong Cork Company, Lancaster, Pa. 1950 ASME Annual Meeting paper No. **50—A-34** (in type; to be published in the *Journal of Applied Mechanics*).

IN the calendering, or rolling, of a plastic material into sheet form by passing it between parallel rolls, hydrostatic pressure is exerted against the surface of the roll throughout the region of contact with the plastic mass. This pressure has been measured by means of a pressure-sensitive cylinder, inserted in the body of a 10-in-diam roll, together with high-speed oscillographic technique. The materials which were calendered consisted of a resin which exhibited flow properties characteristic of a viscous liquid, and several filled plastic compositions of commercial interest. Pressure maxima ranging up to 8000 psi were observed. Comparison of experimental results with theoretical expressions for pressure distribution, as given by several authors, indicates that the equation derived by Gaskell quite satisfactorily predicts the results for the case of the viscous liquid. The commercial plastics were found to exhibit pressure-distribution characteristics which were perceptibly different from those of the viscous liquid. Certain limitations of Gaskell's treatment of nonviscous materials prevent its application to these experimental results.

Approximate Solutions of Compressible Flows Past Bodies of Revolution by Variational Method, by Chi-Teh Wang, New York University, New York, N. Y., and Socrates de Los Santos, Far Eastern University, Manila, Philippines. 1950 ASME Annual Meeting paper No. **50—A-33** (in type; to be published in the *Journal of Applied Mechanics*).

USING the direct method of Rayleigh-Ritz in the calculus of variations, the problem of steady irrotational compressible flow past a body of revolution of arbitrary shape is formulated. In order to compare with the analytical solutions obtained by other investigators, two numerical examples have been carried out, namely, compressible flows past a sphere, and an ellipsoid of revolution. The results are found to be in excellent agreement with those computed by other approximate methods.

On the Extrusion of a Very Viscous Liquid, by Herschel Weil, General Electric Company, Schenectady, N. Y. 1950 ASME Annual Meeting paper No. **50—A-8** (in type; to be published in the *Journal of Applied Mechanics*).

AN approximation to a state of affairs occurring in the extrusion of rubber is the two-dimensional slow flow of a very viscous liquid from a half-plane into a semi-infinite strip. The region surrounding the orifice or juncture of the strip and plane corresponds to the region where the extruded rubber is forced from a die box into a die. Methods are developed and carried out for numerically obtaining the stream function, the velocity components, and the pressure in this region. The general pattern of the streamlines is determined, and it is found in what way and to what extent the flow pattern in the strip near the orifice differs from plane Poiseuille flow and how far into the strip this difference is significant.

Incidental to this work it was necessary to determine the first several complex roots of $\sin A = \pm \frac{2}{3\pi} A$. This information is useful apart from the flow problem, and the results are tabulated.

Evaluation of Stress Distribution in the Symmetrical Neck of Flat Tensile Bars, by Julius Aronofsky, Jun. ASME, Magnolia Petroleum Company, Dallas, Texas. 1950 ASME Annual Meeting paper No. **50—A-14** (in type; to be published in the *Journal of Applied Mechanics*).

THE local strains and the strain distribution in the necks of two flat tensile specimens have been measured. A strain-hardening function for the material was obtained from the results of tension tests on round bars. This strain-hardening function and the measured strains are used to determine the stress distribution in the neck. Good agreement between the calculated and the measured fracture load was obtained.

Plastic-Wave Propagation Effects in High-Speed Testing, by E. H. Lee, Mem. ASME, Brown University, Providence, R. I., and H. Wolf, Hofstra College, Long Island, N. Y. 1950 ASME Annual Meeting paper No. **50—A-35** (in type; to be published in the *Journal of Applied Mechanics*).

A MATERIAL test carried out at high speed may be markedly influenced by plastic-wave propagation effects. In such a case, a variation of strain occurs along the test specimen, and the stress-strain relation cannot be determined from measurements made on the specimen as a whole. If average values are taken, it is shown that a spurious strain-rate influence will be deduced when propagation effects first begin to appear as the testing speed is increased. The effect is due not to a true material strain-rate dependence, but to the appearance of strain variations along the specimen, and its magnitude depends upon the dynamics of the whole test arrangement.

The theoretical plastic-wave analysis of a particular test arrangement is also given. The range of speed is determined which permits satisfactory interpretation without the need for detailed analysis of plastic-wave propagation. Application to other test arrangements is discussed, and it is pointed out that a theoretical analysis can, in general, be made to predict the permissible speed range in planning a high-speed testing program.

Shakedown in Continuous Media, by P. S. Symonds, Cambridge University, Cambridge, England. 1950 ASME Annual Meeting paper No. **50—A-17** (in type; to be published in the *Journal of Applied Mechanics*).

A NEW and simpler proof is given for a theorem due to Melan concerning the conditions under which an elastic-plastic body will "shake down," i.e., reach a residual stress state on which only elastic stresses are superimposed for all further variations of the surface loading stresses within limits prescribed at surface points. The theorem is applied to discuss the case of a circular bar subject to an axial force and a torsional moment which vary independently between given limits. Relations to previous work on trusses and rigid frames are discussed briefly.

The Propagation of Longitudinal Waves of Plastic Deformation in a Bar of Material Exhibiting a Strain-Rate Effect, by L. E. Malvern, Carnegie Institute of Technology, Pittsburgh, Pa. 1950 ASME Annual Meeting paper No. **50—A-18** (in type; to be published in the *Journal of Applied Mechanics*).

THE theory of propagation of longitudinal waves of plastic deformation is extended to apply to materials in which the stress is a function of the instantaneous plastic strain and strain rate. Solutions are given for an idealized flow law and compared with solutions based upon earlier theories which neglect strain-rate effect.

Stresses in Pipe Bundles, by H. Poritsky, Mem. ASME, and G. Horvay, General Electric Company, Schenectady, N. Y. 1950 ASME Annual Meeting paper No. **50—A-80** (in type; to be published in the *Journal of Applied Mechanics*).

FOR purposes of stress analysis, a closely packed bundle of very many pipes can be replaced by a homogeneous but nonisotropic solid (HNS for short). This paper deals with the derivation of the elastic constants of the HNS, the solution of its stress problem under certain conditions, and the conversion of the results into stresses and displacement of individual pipes. As an example the thermal stresses are determined that arise in a pipe bundle due to a nonuniform axial temperature gradient.

On Elastic Continua With Hereditary Characteristics, by Enrico Volterra, Mem. ASME, Illinois Institute of Technology, Chicago, Ill. 1950 ASME Annual Meeting paper No. **50—A-32** (in type; to be published in the *Journal of Applied Mechanics*).

IN a previous paper the free and forced vibrations of systems of one degree of freedom with hereditary damping characteristics were discussed. In the present paper the classical equations of motion for elastic media are extended on the basis of the general linear stress-strain law involving hereditary damping. These equations are applied to the case of free radial vibrations of a sphere. Furthermore, the free vibrations of strings, the free transverse vibrations of beams, and the free vibrations of rectangular and circular membranes are studied under the assumption of hereditary damping.

Vibration of Rectangular and Skew Cantilever Plates, by M. V. Barton, Mem. ASME. The University of Texas, Austin, Texas. 1950 ASME Annual Meeting paper No. **50—A-12** (in type; to be published in the *Journal of Applied Mechanics*).

THE Ritz method is used to determine approximate solutions for the frequencies and modes of vibration of uniform rectangular and skew cantilever plates. The functions used to represent the plate deflection correspond to those which define the normal modes of vibration of a uniform beam. Solutions are obtained for (*a*) uniform rectangular cantilever plates with cantilever span-to-breadth ratios of $^1/_2$, 1, 2, and 5; (*b*) uniform skew cantilever plates with sides of equal length and skew angles of 15 deg, 30 deg, and 45 deg. Experimental values are presented and the correlation with analytical results discussed.

Free Vibrations of a Pin-Ended Column With Constant Distance Between Pin Ends, by David Burgreen, Polytechnic Institute of Brooklyn, Brooklyn, N. Y. 1950 ASME Annual Meeting paper No. **50—A-9** (in type; to be published in the *Journal of Applied Mechanics*).

IN this paper a study is made of the free vibrations of a pin-ended column whose ends are pinned to points fixed in space. This imposes the condition of constant end distance instead of the usual theoretical assumption that the load on the column remains constant. The differential equation of the system is nonlinear, and, with the assumptions that are made, is found to have an exact solution in terms of elliptic functions. Dependent upon the initial amplitude of deflection and the compressive load on the column, several types of vibrations are found to exist. The variation of frequency and wave form with the load-amplitude parameter is discussed. In particular, it is found that the frequency is dependent upon the amplitude of vibration, the effect of the amplitude of vibration becoming more pronounced as the Euler load is approached. For a column under the Euler load the classical theory gives the frequency of vibration as zero. The present theory shows that for finite amplitudes of vibration the frequency is not zero. Experimental results are presented, and a comparison of the theoretical and experimental frequencies and wave shapes is made.

Transverse Vibrations of a Free Circular Plate Carrying Concentrated Mass, by R. E. Roberson, Jun. ASME, Naval Research Laboratory, Washington, D. C. 1950 ASME Annual Meeting paper No. **50—A-24** (in type; to be published in the *Journal of Applied Mechanics*).

THE plate under consideration carries a concentrated mass at its center, which is struck impulsively in a direction perpendicular to the undisturbed plate face. Only circularly symmetric vibrations are considered. The solution is carried out by the use of the Laplace transform method, treating the concentrated mass as a plate-density impulse. The first four natural frequencies are displayed as functions of mass ratio, and the first mode shape is displayed for three mass ratios. The natural frequencies, particularly the higher, are shown to be very sensitive to changes in mass ratio at small values of the concentrated mass.

Sinusoidal Torsional Buckling of Bars of Angle Section Under Bending Loads, as a Problem in Plate Theory, by H. J. Plass, Jr., Stanford University, Stanford, Calif. 1950 ASME Annual Meeting paper No. **50—A-15** (in type; to be published in the *Journal of Applied Mechanics*).

TIMOSHENKO has applied plate theory to each leg of an angle section bar to determine the critical compressive load needed to cause sinusoidal torsional buckling. In this paper his idea is used to calculate the critical bending load

needed to cause sinusoidal torsional buckling of an angle bar. The bending is assumed to be applied so that the extreme fibers of the angle are in compression, the vertex in tension. Approximate results are first obtained by means of the Rayleigh-Ritz method. The approximate deflection functions from which the energy terms are computed are based upon certain infinite-series solutions. After having obtained approximate results, exact values are obtained, using the approximate values as a guide to limit the amount of calculation. The results of this calculation are compared with those predicted by bar theory. Differences between the two theories become more noticeable as the bar becomes short compared to its flange width. It is found that the critical bending load becomes larger very rapidly as the ratio of length to width of the flanges decreases. Bar theory predicts no such increase. The reason for this difference is explained.

On the Stability of Plates Reinforced by Longitudinal Ribs, by J. M. Klitchieff, Belgrade University, Belgrade, Yugoslavia. 1950 ASME Annual Meeting paper No. **50—A-10** (in type; to be published in the *Journal of Applied Mechanics*).

THE stability of plates reinforced by any number of equal and equidistant longitudinal ribs has been considered. By transformation of the system of equations established by S. Timoshenko the general solution of it has been developed, giving directly the rigidity of ribs required to secure any given critical compressive force of the plate. Two numerical examples of stiffenings used in ship design have been discussed.

Buckling of a Sandwich Cylinder Under Uniform Axial Compressive Load, by A. Cemal Eringen, Illinois Institute of Technology, Chicago, Ill. 1950 ASME Annual Meeting paper No. **50—A-3** (in type; to be published in the *Journal of Applied Mechanics*).

A BOUNDARY-VALUE problem of elasticity for a thick hollow circular cylinder is solved under the following boundary conditions, namely, (*a*) on the lateral surfaces, displacements are specified as arbitrary functions of the longitudinal co-ordinates only, and (*b*) at both ends, the radial displacements and the longitudinal surface forces are taken to be equal to zero. The displacements, strains, and stresses are obtained in terms of these arbitrary displacement functions. The stresses determined are used to obtain the buckling load of a sandwich cylinder, which employs the thick hollow cylinder as the core. Two simultaneous differential equations are obtained from the equilibrium conditions between the contacting lateral surfaces of the sandwich material (faces) and the core. Numerical calculations and curves are made of the buckling stress for a given core material and for two types of face materials employed in aircraft design. In a special case, when the radius approaches infinity, the result is found to be in good agreement with previously published experimental results. No test data for the general case were available to the author during the preparation of this paper.

Analysis of Straight and Curved Beam Columns, by C. M. Tyler, Jr., Jun. ASME, Carnegie Institute of Technology, and J. G. Christiano, University of Pittsburgh, Pittsburgh, Pa. 1950 ASME Annual Meeting paper No. **50—A-11** (in type; to be published in the *Journal of Applied Mechanics*).

A METHOD of analysis is developed for calculating the effects of deflection and axial force on the bending moments of structural members having both beam and column loadings. The member is divided into a number of segments and analyzed by a relaxation method directly in terms of the bending moments at each segment. This analysis is applicable to beam-columns of any shape and stiffness, and for any type of loading. A numerical example of an irregularly curved beam column is included.

Large-Deflection Theory for Plates With Small Initial Curvature Loaded in Edge Compression, by J. M. Coan, University of Illinois, Urbana, Ill. 1950 ASME Annual Meeting paper No. **50—A-2** (in type; to be published in the *Journal of Applied Mechanics*).

THIS investigation of the buckling of a simply supported, rectangular, isotropic plate with small initial curvature was undertaken to evaluate current procedures for deducing the true (flat plate) critical load from the measured deflections and strains of a nominally flat plate. The boundary conditions are those that are usually met in test practice but which have not been satisfied by earlier studies, i.e., stress-free supported edges and uniformly displaced loaded edges. Previous solutions require a distribution of transverse stress along the supported edges sufficient to keep them straight and parallel at all times. However, in most test specimens, the freedom of the supported edges to distort in the plane of the plate measurably influences the behavior of the plate and the stress distribution within it. Levy's solution of von Kármán's "large deflection" equations is adapted by the author to yield the nonuniform edge displacements that are characteristic of stress-free supported edges. Limited experimental evidence tends to confirm the predictions of this analysis.

The Limit Design of Space Frames, by Jacques Heyman, Brown University, Providence, R. I. 1950 ASME Annual Meeting paper No. **50—A-4** (in type; to be published in the *Journal of Applied Mechanics*).

THE Greenberg-Prager maximum-minimum method for the limit design of plane frames is extended to space frames. This method furnishes upper and lower bounds for the load factor at collapse, and the bounds may be made as close as is considered necessary by a rational system of successive approximation.

Axially Symmetrical Plates With Linearly Varying Thickness, by H. D. Conway, Jun. ASME, Cornell University, Ithaca, N. Y. 1950 ASME Annual Meeting paper No. **50—A-6** (in type; to be published in the *Journal of Applied Mechanics*).

THE most practical problem in the bending of symmetrically loaded circular plates of variable thickness is probably that in which the thickness decreases linearly with the distance from the center of the plate. A general solution of the small-deflection problem of such plates is given here in closed form for the special case when Poisson's ratio is 1/3. Numerical results are given for two particular examples, and these are compared with the results for corresponding plates of constant thickness.

Some Thin-Plate Problems by the Sine Transform, by L. I. Deverall and C. J. Thorne, University of Utah, Salt Lake City, Utah. 1950 ASME Annual Meeting paper No. **50—A-13** (in type; to be published in the *Journal of Applied Mechanics*).

GENERAL expressions for the deflection of thin rectangular plates are obtained for cases in which two opposite edges have arbitrary but given deflections and moments. The sine transform is used as a part of the method of solution, since solutions can be found for an arbitrary load for each set of edge conditions at the other two edges. Even for the classical cases, the use of the sine transform makes the process of solving the problem much easier. The six

general solutions given are those which arise from all possible combinations of physically important edge conditions at the other two edges. Solutions for a specific load function can be found by integration or by the use of a table of sine transforms. Tables useful in application of the method to specific problems are included.

Analysis of Deep Beams, by H. D. Conway, Jun. ASME, L. Chow, and G. W. Morgan, Cornell University, Ithaca, N. Y. 1950 ASME Annual Meeting paper No. **50—A-7** (in type; to be published in the *Journal of Applied Mechanics*).

THIS paper presents a method of analyzing the stress distribution in a deep beam of finite length by superimposing two stress functions. The first stress function is chosen in the form of a trigonometric series which satisfies all but one of the boundary conditions—that of zero normal stress on the ends of the beam. The principle of least work is then used to obtain a second stress function giving the distribution of normal stress on the ends which is left by the first stress function. By superimposing the two solutions, all the boundary conditions are satisfied. Two particular cases of a given type of loading are solved in this way to investigate the stresses in a deep beam and their deviation from the ordinary beam theory. In addition, an approximate solution by the numerical method of finite difference is worked out for one of the two cases. Results from the two methods are compared and discussed. A method of obtaining an exact solution to the problem is given in an appendix.

The Torsion of Elastic Spheres in Contact, by J. L. Lubkin, Jun. ASME, Midwest Research Institute, Kansas City, Mo. 1950 ASME Annual Meeting paper No. **50—A-1** (in type; to be published in the *Journal of Applied Mechanics*).

A SMALL torsional couple is applied about the axis of symmetry of a system of two elastic spheres (or solids of revolution) which have been pressed together by a force perpendicular to their common tangent plane. This problem may be reduced to a "problem of the plane," and it has been found that in the absence of slip on the interface, the tangential traction is singular on the bounding circle. Hence the assumption of no slip is physically untenable. In the present solution allowance is made for slip by assuming that the tangential component of traction, for the area over which slip has progressed, is equal to the product of a constant friction coefficient and the normal or Hertzian distribution. A continuous expression for the traction is developed. A formula relating the radial depth of penetration of slip to the magnitude of the applied moment is given, and another relating this moment to the rotation of the contact surface of one of the bodies with respect to remote points in that body.

A Fourier Integral Solution for the Plane-Stress Problem of a Circular Ring With Concentrated Radial Loads, by Carl W. Nelson, Jun. ASME, University of California, Berkeley, Calif. 1950 ASME Annual Meeting paper No. **50—A-16** (in type; to be published in the *Journal of Applied Mechanics*).

A FOURIER integral solution for the stresses in a straight bar of uniform cross section loaded by various combinations of loads applied normally to the edges of the bar was published by L. N. G. Filon in 1903. Solutions for the stresses in circular rings, loaded on one or both boundaries by radial loads, have been limited to Fourier-series solutions for closed circular rings, except that solutions in closed form have been obtained for the limiting cases which occur either when the inner radius becomes very small or when the outer radius becomes very large. This paper presents a Fourier integral solution for the plane-stress problem of a curved bar bounded by two concentric circles and loaded by radial loads on the circular boundaries. It treats only the particular case of a curved bar in equilibrium under the action of two equal and opposite radial forces, one on each boundary. However, the method can be extended so as to deal with other combinations of loads. Sufficient numerical results are given to show that the Fourier integral method permits the calculation of numerical values of the stresses in the particular case considered. It is the purpose of this paper to show that the Fourier integral method can be used successfully in what is probably the simplest problem of concentrated loads acting on a curved bar, and to furnish a background of material for use in less simple problems such as bending of curved bars due to concentrated loads.

A Note on Elastic-Surface Deformation, by M. Kornhauser, Navy Department, Bureau of Ships, Washington, D. C. 1950 ASME Annual Meeting paper No. **50—A-30** (in type; to be published in the *Journal of Applied Mechanics*).

SURFACE deformation of elastic bodies having the same modulus is treated by the standard texts on elasticity, but the applicability of the solution is limited to the range of the tables of coefficients presented. This note extends the tables to cover the range that applies to bodies having one principal curvature much larger than the other. Some inaccuracy in the tables in current use also is noted. The reader is referred to any good text on elasticity for a general discussion of this problem.

Wood Technology

The Field of Engineering in Forest Protection, by Gilbert I. Stewart, Michigan Forest Fire Experimental Station, Michigan Department of Conservation, Roscommon, Mich. 1950 ASME Annual Meeting paper No. **50-A—107** (mimeographed; to be published in MECHANICAL ENGINEERING).

PROTECTION of the forest resources of the nation through fire control is a "complex field of engineering" where the scope of development is almost unlimited.

The difficulties of fire fighting lie not in the method, but in the development and manufacture of suitable machinery capable of performing effective work under woods conditions. In addition to predicting the use of new types of equipment and the eclipse of the crawler tractor, this paper states that the uses of chemicals have barely been investigated; application of aircraft in actual suppression work is in its infancy; and the helicopter faces a bright future especially in wilderness country.

Throughout the nation as a whole, modern fire control is accomplished through mechanization of equipment with two major benefits: simplification of organization which permits fewer men to accomplish prompt and effective work; and a market increase in work capacity and efficiency of individuals or groups.

Much of the woodland of the United States is restocking a heavy, second growth of timber, and forest conditions are changing rapidly. Density and size of timber stands are increasing, due to continued fire protection.

It is for this reason that the extensive and free operations of crawler tractors will be restricted and other kinds of machines will find their place as line builders. The new types of equipment will modify present fire-fighting procedures.

Fire fighting equipment is divided into two classifications of transportation and suppression. Suppression equipment in-

volves a wide variety of machines, and in any one region or locality, woods conditions determine its composition. Every suppression machine must be capable of operating in woods under abusive conditions, and off the road.

In controlling a running fire the immediate problem consists of stopping the moving perimeter, especially the head which moves at the fastest rate. Effective methods can be made relatively simple if machinery is employed, and usually consist of constructing firelines or barriers as close to the burning edges as possible or subduing the burning fuel with water.

For the most part, barriers must be built with heavy plows or other dirt-turning equipment, or the fire must be stopped with tanker units and powerful pressure pumps.

Special Methods of Drying Wood, by Harold Tombach, La Follette, Tenn. 1950 ASME Annual Meeting paper No. 50-A—109 (mimeographed).

SPECIAL processes of drying wood faster than the conventional methods of air seasoning and kiln drying, are already being used on a limited commercial scale and probably will find wider application in the future.

The special methods discussed in this paper were vacuum seasoning, drying with superheated steam, vapor drying, boiling in oil, drying with infrared rays, dielectric heating, and solvent seasoning.

The slowness and relative expensiveness of the conventional methods of drying wood have always been of major concern to the woodworking industry. A considerable amount of thought has been spent in inventing new processes, with the chief aim of expedient drying in mind.

The success of these special methods has often been hampered by either one or both of the following facts: Speedy drying has resulted in poorer seasoning quality; intricate equipment has made the process too expensive for general application.

Among the items making up the cost account of any drying process, there are some where conventional kiln-drying is hard to beat, the paper pointed out. This is the case in regard to cost of unit of heat generated and of drying medium employed, since in kiln-drying usually cheap steam and air at no cost are used. Also in most cases, special methods require more expensive equipment.

However, there are other cost items where special methods have some chance to compete with their well-established rival. One obvious one is reduced interest on capital invested in lumber, because of more rapid turnover. Also in some cases, labor cost and degrade of the seasoned wood may be reduced.

Further, because of more rapid turnover, amortization cost of the drying equipment may be lower. Finally, it is conceivable that some savings could be accomplished through reduction of the amount of unprofitable heat losses, which are rather high with conventional kilns.

Because of the insufficient speed of drying, none of the processes can be used for continuous or conveyer drying of wood in lumber sizes. All processes can be used for batch drying, except when the lumber is heated by radiation, and in the case of radio-frequency heating the size of the batches necessarily will be very limited. The radio-frequency and radiation processes require electricity for producing heat, while the other methods use steam or other heating means.

The expensiveness of the drying equipment is a major cost item with vacuum, vapor, dielectric, and solvent seasoning.

In drying to low-moisture contents, a quality of seasoning comparable to that found with kiln-drying, or even better, may be obtained with the vacuum, dielectric heating, and solvent processes, in cases where these are applicable. Severe case-hardening of lumber dried to lower moisture contents is characteristic of processes using nonpolar drying agents, for instance the vapor drying and boiling in oil.

Tests showed that boiling-in-oil gives relatively good results when the moisture reduction is limited, that is, the wood either is dried from the green state to a moisture content above the fiber saturation point, or from a moisture content below the fiber saturation point to any final moisture content. It is very likely that analogous results are found with vapor drying.

Pervious woods which permit rapid movements of liquids and vapors through coarse capillary structure obviously give best results with any method, but no successful means has yet been devised to obtain the same results with refractory woods.

None of the known special methods seems to bear the promise of a universal solution of the problem of drying wood rapidly, economically, and without seasoning degrade. However, even if only applicable in particular cases, they contribute to a progress in manufacturing specific articles, and also to a better understanding of the intricate mechanism of drying wood. Progress of science has no limits, and investigators, inventors, research institutions, and laboratories are still at work in the hope of finding a better solution for the problem that looks so simple but in reality has proved to be a difficult one.

ASME Transactions for December, 1950

THE December, 1950, issue of the Transactions of the ASME, which is the *Journal of Applied Mechanics* (available at $1 per copy to ASME members; $1.50 to nonmembers) contains the following:

TECHNICAL PAPERS

Effect of Stress-Free Edges in Plane Shear of a Flat Body, by W. T. Read. (50—APM-6)

The Stresses Around a Small Opening in a Beam Subjected to Pure Bending, by J. A. Joseph and J. S. Brock. (50—APM-3)

Torsion of a Circular Shaft With a Number of Longitudinal Notches, by H. Ōkubo. (50—APM-7)

Vibrations of Elastic Systems Having Hereditary Characteristics, by Enrico Volterra. (50—APM-8)

Plastic Biaxial Stress-Strain Relations for Alcoa 24S-T Subjected to Variable-Stress Ratios, by Joseph Marin and B. J. Kotalik. (50—APM-16)

Beam Vibrations With Time-Dependent Boundary Conditions, by R. D. Mindlin and L. E. Goodman. (49—A-19)

Temperature Distribution in a Steady, Laminar, Preheated Air Jet, by Chia-Shun Yih. (50—APM-5)

Elastic Torsion in the Presence of Initial Axial Stress, by J. N. Goodier. (50—APM-4)

Torsional Stress Concentration in Angle and Square Tube Fillets, by J. H. Huth. (50—APM-9)

Natural Frequencies of Continuous Beams of Uniform Span Length, by R. S. Ayre and L. S. Jacobsen. (50—APM-21)

On the General Theory of Thin Shells, by W. R. Osgood and J. A. Joseph. (50—APM-14)

Momentum and Mass Transfer in Coaxial Gas Jets, by Walton Forstall, Jr., and A. H. Shapiro. (50—APM-13)

Impact on a Multispan Beam, by W. H. Hoppmann, 2nd. (50—APM-15)

The Theory of Spring-Loaded Valves for Reciprocating Compressors, by Michael Costagliola. (50—APM-12)

Characteristics of Irrotational Flow Through Axially Symmetric Orifices, by Hunter Rouse and Abdel-Hadi Abul-Fetouh. (50—APM-11)

The Design of Resonant Quartz-Crystal Ultrasonic Transducers for Research Purposes, by G. W. Swenson, Jr., and W. T. Thomson. (50—SA-12)

The Uniform Distribution of a Fluid Flowing Through a Perforated Pipe, by W. M. Dow. (50—SA-14)

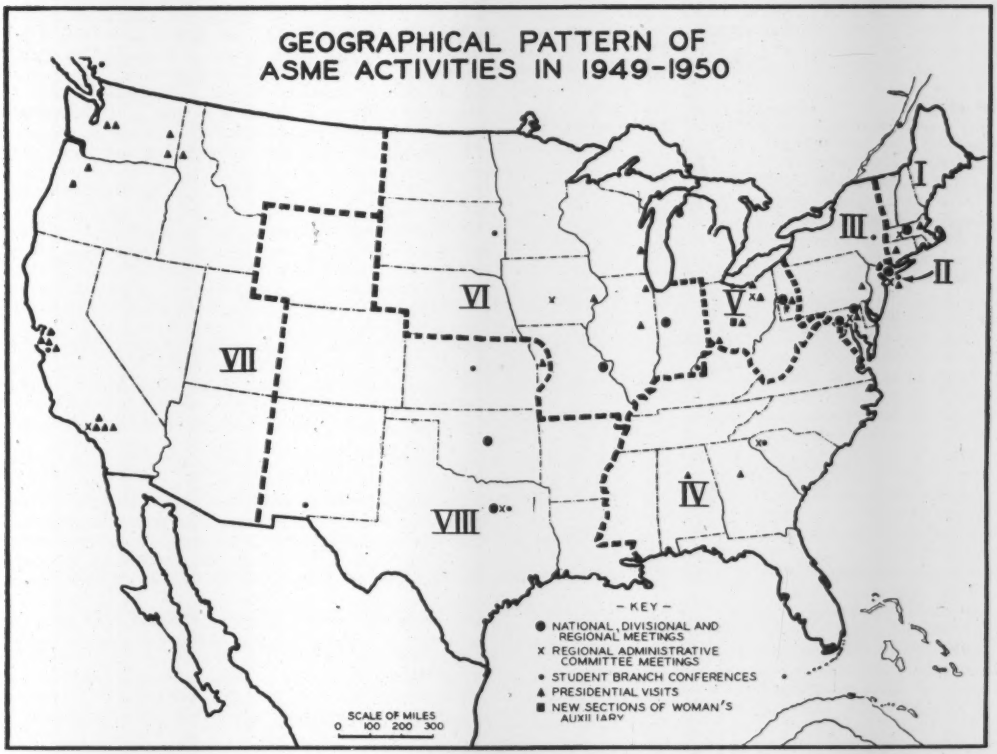
Measurements of Diffraction of Shock Waves and Resulting Loading of Structures, by W. Bleakney, D. R. White, and W. C. Griffith.

The Use of Skewed Rolls in Calendering Operations, by G. F. Carrier. (50—APM-10)

Vibration of Rectangular Plates by the Ritz Method, by Dana Young. (50—APM-18)

DISCUSSION On Previously Published Papers.

BOOK REVIEWS



AN INTENSIVE LOOK *at the* 1950 ASME YEAR

The ASME Council Summarizes the Work and the Results

THE wide range of specialization, of age and experience, and of function in the 34,341 members and 18,721 students that make up the Society, challenge our ingenuity to find a hard core of interest on which to build our report to you. That core of interest is certainly not made of numbers—numbers of members or of papers or of registrants at meetings—nor is it necessarily made of dollars of income, or expense, or surplus, or investment. The core of interest is rather the satisfaction that comes from participation in a Society of high-minded men who strive to better their profession, their community, and themselves through the medium of the Society. As engineers, we like to measure our results, but satisfaction in work well done defies measurement.

Hence, in reviewing the achievements of the seventieth year of Society life, we wish to express the satisfactions we enjoy in the deep fast-flowing stream of good works that it is our privilege as Council members to witness. As quantitative measures of these good works, we include some figures and charts that represent values not of our satisfaction but of the results of members' activities which have given them the satisfactions of accomplishment.

CONSPICUOUS ACHIEVEMENTS IN TECHNOLOGY

We heartily endorse the efforts of the Board on Technology and the Professional Divisions for their achievements in improving the quality of meetings, papers, and publications. These will have far-reaching effects on the progress of mechanical engineering. The Meetings Committee, the Professional Divisions, the Sections, and the many local committees have provided the members with a wealth of useful material

TABLE 1 LIST OF ASME NATIONAL MEETINGS AND CONFERENCES 1949–1950

Meetings	Number of Days	Number of Sessions	Number of Papers	Attendance
Petroleum Mechanical-Engineering Conference, Oct. 2–5, 1949, Oklahoma City, Okla.	4	13	27	210
Fuels Conference, Oct. 26–27, 1949, French Lick, Ind.	2	3	8	230
Annual Meeting, Nov. 27–Dec. 2, 1949, New York, N. Y.	5	73	200	5,386
Spring Meeting, April 12–14, 1950, Washington, D. C.	3	21	50	1,099
Process Industries Conference, April 24–26, 1950, Pittsburgh, Pa.	3	12	24	625
Oil and Gas Power Conference, June 12–16, 1950, Baltimore, Md.	5	6	11	345
Semi-Annual Meeting, June 19–23, 1950, St. Louis, Mo.	5	24	52	765
Applied Mechanics Conference, June 22–24, 1950, Lafayette, Ind.	3	6	23	190
Industrial Instruments and Regulators Conference, Sept. 18–22, 1950, Buffalo, N. Y.	2	4	14	500*
Fall Meeting, Sept. 19–21, 1950, Worcester, Mass.	3	25	52	670
Petroleum Mechanical Engineering Conference, Sept. 25–28, 1950, New Orleans, La.	4	15	37	390
	39	202	498	10,410

* Estimated.

in the four national meetings, 12 Divisional Conferences, and 830 meetings of the 73 Sections. At Society meetings and conferences alone 498 papers were presented to enrich the technical literature of our field. But we went beyond strictly technical interests. Who can have heard Judge Vanderbilt at the Annual Meeting or Detlev Bronk at the Spring Meeting without resolving to become a better citizen and a better engineer? And the sessions held by the Juniors at Washington, St. Louis and Worcester; did they not make a lasting impression on our younger members? Our 129 student branches held 831 meetings and met in 12 Regional Conferences and thus gave hundreds of young men a practical demonstration of the manner in which engineers conduct Society affairs and exchange professional and technical information for their mutual benefit. Region VIII held a successful regional meeting in Dallas, Texas, the first of three on an experimental basis.

The publication plan, which permits the Society to publish more papers for less money, operated more smoothly in its third year. MECHANICAL ENGINEERING, which now abstracts all Society papers, held its position as a leader among Society magazines. A large volume of special publications were produced for sale. The most spectacular of these new publications was a book on Small Plant Management, produced by the Management Division. The research program consists of eleven active projects on which over $30,000 was spent during the year. In support of these projects, during their life, industry has contributed about one million dollars in cash, services, and materials. The Board on Codes and Standards approved 29 new or revised Codes and Standards. This means that the Society Standards program is being advanced at a greater rate than ever before and that most of the individual documents have been brought up to date with current practice.

The reports of the numerous ASME Boards and Committees contain the details of the vast amount of technical work in progress under their auspices. They present convincing evidence that our technical life is most active. Without this substantial core of technical activity our Society cannot be strong, and it is a source of great satisfaction to us that so many members are devoting their efforts to improving and increasing the Society's contributions in this area and that the results are so impressive. We are particularly gratified that in the fundamental field of design our meetings and publications have produced such a large volume of useful material and that in the newer fields of heat transfer, instruments, and the gas turbine our members have given us many exceptional papers. And we note with satisfaction that our Society continues to provide the greatest source of material on steam-power problems.

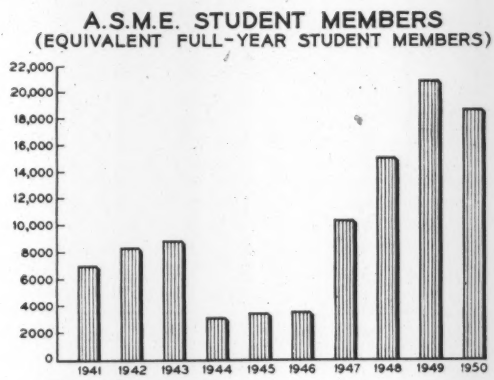
HEALTHY CONDITION OF ASME

The Society is strong and its influence and activities are widely distributed geographically. The Society is where the members live. The eight Regional Administrative Committees, at meetings held in the spring under the leadership of the Vice-Presidents, discussed suggestions for general Society betterment. It is particularly encouraging to see the increasing interest among the Juniors in Society activity. The Regional Delegates Conference at St. Louis displayed real statesmanship in the policies it enunciated, particularly in recognizing that the individual member and his employer benefit from services performed for the Society, thus strengthening the relationship of industry and the Society. Their objective and businesslike recommendation for an increase in dues was a source of great

TABLE 2 FINANCIAL DATA FOR ELEVEN ACTIVE COMMITTEES

Cash contributions, fiscal year 1950.....$34,875.00
Cash disbursements, fiscal year 1950.....$30,737.77

Active research projects, Fiscal year 1950	Summary to Sept. 30, 1950 Contributions to September 30, 1950 Cash	Services and Materials	Total
Fluid meters	$ 43,597	$156,225	$ 199,822
Boiler feedwater studies	80,282	100,000	180,282
Effect of temperature on the properties of metals	61,317	83,000	144,317
Lubrication	49,219	90,300	139,519
Furnace performance factors	24,049	75,000	99,049
High temperature steam generation	38,983	43,920	79,903
Plastic flow of metals	47,621	18,954	66,575
Metal cutting data and bibliography	8,150	55,000	63,150
Cutting fluids	10,706	17,300	28,006
Gas properties	9,650	10,000	19,650
Automatic regulation theory	2,995	3,000	5,995
TOTAL	$376,569	$652,699	$1,026,268



encouragement to those of us who must wrestle with higher costs and budgetary demands.

WORLD-WIDE INFLUENCE OF ASME

In our professional and international relationships we can take great pride. It is reason for satisfaction that ASME is participating in an exploratory group of 16 societies that is trying to bring the engineering profession into greater unity; that ASME is participating in an Engineering Manpower Commission, established by EJC and charged with the responsibility of developing a plan for better use of engineers in time of emergency; that ECPD has come forth with a practical program for postcollege training; that through EJC progress is being made in organizing co-operation with the engineering societies of the hemisphere, and finally that ASME is called upon to take international responsibility in standardization, particularly in boiler code, power test codes, and screw-thread standards.

LIBRARY

We report with pleasure that the Engineering Societies Library, of which our Library is a part, served 23,000 visitors and received 15,000 mail requests for service.

WOMAN'S AUXILIARY

The Woman's Auxiliary is usefully active, is increasing in numbers and influence, and this year established 2 new branches, making 11 in all.

* * * * *

We take satisfaction that our members number 34,341, a new high, but we express deep regret at the death of 172, among whom were such valiant leaders as Charles M. Allen and Francis Hodgkinson.

ASME FINANCIALLY SOUND

We are pleased to report that the Society operated its finances in the black, as is shown in the accompanying financial report.

In preparing our budget for 1950–1951 we faced increased costs and the possibility that net publication income would

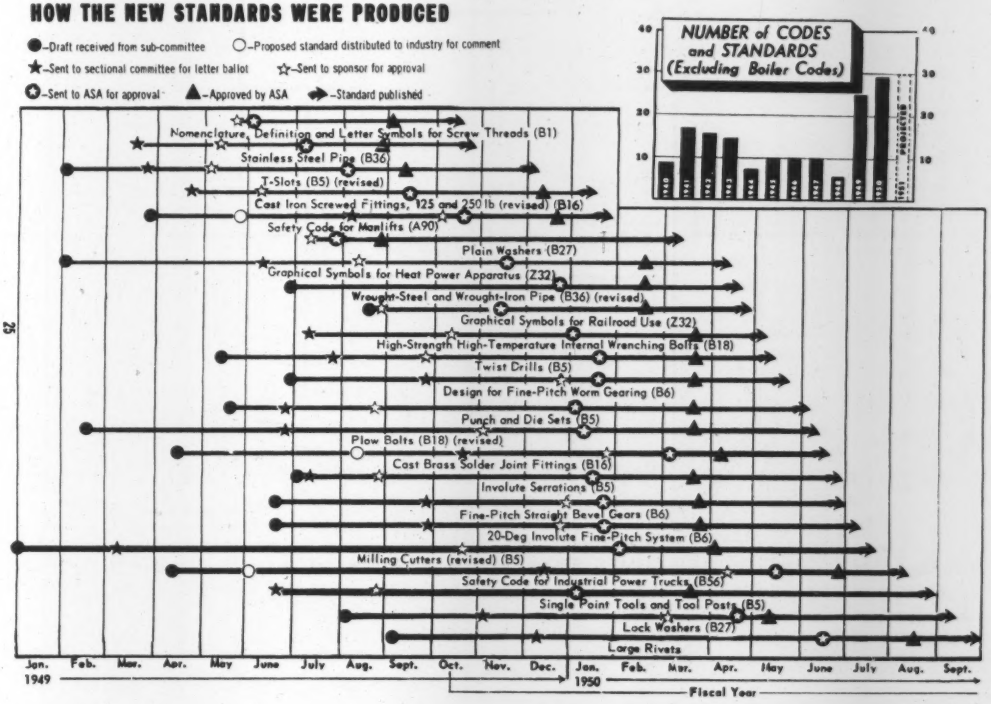

HOW THE NEW STANDARDS WERE PRODUCED
●–Draft received from sub-committee
○–Proposed standard distributed to industry for comment
★–Sent to sectional committee for letter ballot
☆–Sent to sponsor for approval
✪–Sent to ASA for approval
▲–Approved by ASA
◆–Standard published
NUMBER of CODES and STANDARDS (Excluding Boiler Codes)
40
30
20
10
PROJECTED
Nomenclature, Definition and Letter Symbols for Screw Threads (B1)
Stainless Steel Pipe (B36)
T-Slots (B5) (revised)
Cast Iron Screwed Fittings, 125 and 250 lb (revised) (B16)
Safety Code for Manlifts (A90)
Plain Washers (B27)
Graphical Symbols for Heat Power Apparatus (Z32)
Wrought-Steel and Wrought-Iron Pipe (B36) (revised)
Graphical Symbols for Railroad Use (Z32)
High-Strength High-Temperature Internal Wrenching Bolts (B18)
Twist Drills (B5)
Design for Fine-Pitch Worm Gearing (B6)
Punch and Die Sets (B5)
Plow Bolts (B18) (revised)
Cast Brass Solder Joint Fittings (B16)
Involute Serrations (B5)
Fine-Pitch Straight Bevel Gears (B6)
20-Deg Involute Fine-Pitch System (B6)
Milling Cutters (revised) (B5)
Safety Code for Industrial Power Trucks (B56)
Single Point Tools and Tool Posts (B5)
Lock Washers (B27)
Large Rivets
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept.
1949
1950
Fiscal Year

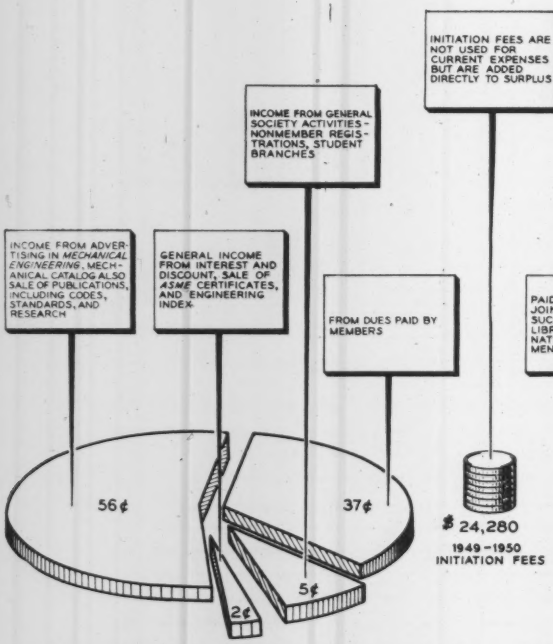
TABLE 3 CHANGES IN MEMBERSHIP

(Sept. 30, 1949, to Sept. 30, 1950)

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1950	Sept. 30, 1949	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net changes
Honorary members	52	45	7	2					2	9	2	+ 7
Fellows	325	284	56		1	6			10	57	16	+ 41
Members	12702	12137	345	572	103	57	120	137	141	1020	455	+ 565
Associates	383	382	1	34	1	3	17	10	4	36	34	+ 1
Junior (20)	3862	3511	750	142	18	217	94	239	10	910	560	+ 351
Junior (15)	3836	3161	1472	359	12	862	50	254	2	1843	1168	+ 675
Junior (10)	13181	11160		4143	17	1486	80	570	3	4160	2139	+2021
Totals	34341	30680	2631	5252	152	2631	361	1210	172	8035	4374	+3661

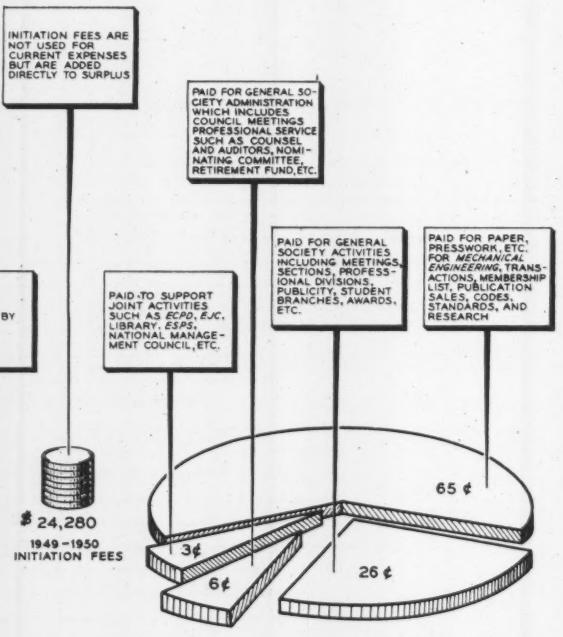
level off, so an increase in dues seemed logical and was recommended to the members.

Looking to next year, we see a troubled world and perhaps the need for our nation to maintain a larger continuing military establishment which, experience has taught us, will demand engineering man power and a high level of achievement in engineering design, production, and operation for military and civilian needs. This presents a challenge to the ingenuity and capacity of the engineering profession and a further opportunity for ASME to be of national service.


INCOME FROM ADVERTISING IN MECHANICAL ENGINEERING, MECHANICAL CATALOG, ALSO SALE OF PUBLICATIONS, INCLUDING CODES, STANDARDS, AND RESEARCH
GENERAL INCOME FROM INTEREST AND DISCOUNT, SALE OF ASME CERTIFICATES, AND ENGINEERING INDEX
INCOME FROM GENERAL SOCIETY ACTIVITIES - NONMEMBER REGISTRATIONS, STUDENT BRANCHES
FROM DUES PAID BY MEMBERS
56¢
37¢
5¢
2¢

WHERE ASME INCOME DOLLAR COMES FROM

TOTAL INCOME 1949-1950 — $ 1,196,948.41


INITIATION FEES ARE NOT USED FOR CURRENT EXPENSES BUT ARE ADDED DIRECTLY TO SURPLUS
$ 24,280
1949-1950 INITIATION FEES
PAID FOR GENERAL SOCIETY ADMINISTRATION WHICH INCLUDES COUNCIL MEETINGS, PROFESSIONAL SERVICE SUCH AS COUNSEL AND AUDITORS, NOMINATING COMMITTEE, RETIREMENT FUND, ETC.
PAID TO SUPPORT JOINT ACTIVITIES SUCH AS ECPD, EJC, LIBRARY, ESPS, NATIONAL MANAGEMENT COUNCIL, ETC.
PAID FOR GENERAL SOCIETY ACTIVITIES INCLUDING MEETINGS, SECTIONS, PROFESSIONAL DIVISIONS, PUBLICITY, STUDENT BRANCHES, AWARDS, ETC.
PAID FOR PAPER, PRESSWORK, ETC. FOR MECHANICAL ENGINEERING, TRANSACTIONS, MEMBERSHIP LIST, PUBLICATION SALES, CODES, STANDARDS, AND RESEARCH
65¢
3¢
6¢
26¢

HOW THE ASME INCOME DOLLAR WAS SPENT

TOTAL EXPENSES 1949-1950 — $1,194,572.50 *

* ADDITION TO SURPLUS $ 2,375.91

ASME Finances

FINANCES[1]

The income of the Society for the year exceeded $1,196,000, the largest income in the history of the Society. The policy of the Council was to use the income of the Society for service to the members. A net income over expense of $2,345.91 is reported. This amount plus initiation and transfer fees amounting to $24,280, make a total addition to surplus for the year of $26,655.91.

The Balance Sheet of September 30, 1950, shows, on that date, that the Society owned:

(1) Current bills and federal tax withheld from employees		$ 6,405.11
(2) Obligations for printing and distributing the 1950 Mechanical Catalog and other bills which have not been submitted		37,359.46
(3) Unexpended appropriations for future services		83,970.79
(4) Special research and other committees which have collected funds for special purposes to be expended as needed		106,257.65
(5) Future services to members who have prepaid dues		155,846.65
(6) Subscribers to publications who have prepaid		4,000.00
		$ 393,839.66

To meet these debts the Society had:

(1) Cash in the bank	162,377.30
(2) Accounts receivable	111,306.68
(3) Inventories of publications and supplies conservatively valued at	81,009.62
(4) Securities (at the lower of cost or approximate quoted market values)	688,109.94
	$1,042,803.54

The difference between the value held by the Society of $1,042,803.54 and debts of $393,839.66 is the net worth of the Society on September 30, 1950, $648,963.88, of which $500,000.00 has been set aside as a general reserve against contingencies, leaving a balance of ..... $ 148,963.88

The Society had other liabilities:

(1) Development Fund of		$ 51,930.76
Against which it had		
(a) Cash	$ 1,770.56	
(b) Securities (at the lower of cost or approximate quoted market values)	45,660.20	
(c) Notes receivable	4,500.00	
	$ 51,930.76	
(2) Employees' Retirement Fund of		$ 102,333.96
Against which it had		
(a) Cash	$ 12,657.48	
(b) Securities (at the lower of cost or approximate quoted market values)	89,676.48	
	$ 102,333.96	
(3) Trust Funds amounting to		$ 170,372.63
Against which the Society had the following assets:		
(a) Cash	$ 26,830.63	
(b) Securities (at the lower of cost or approximate quoted market values)	$143,542.00	
	$170,372.63	
(4) Property Fund of		$ 562,139.80
With the following assets to support it:		
(a) Quarter interest in building	$498,448.48	
(b) Office furniture and fixtures (depreciated value)	63,689.32	
(c) Library books	1.00	
(d) Engineering Index, Inc.—Title and good will	1.00	
	$562,139.80	

[1] The certified report of the auditors, Price, Waterhouse & Co., is on file in the Society office and available for inspection by the members.

Table 4 shows the income and expense for the major groupings of Society activities. Table 5 shows the activities which produce an income and those which result in a net expense.

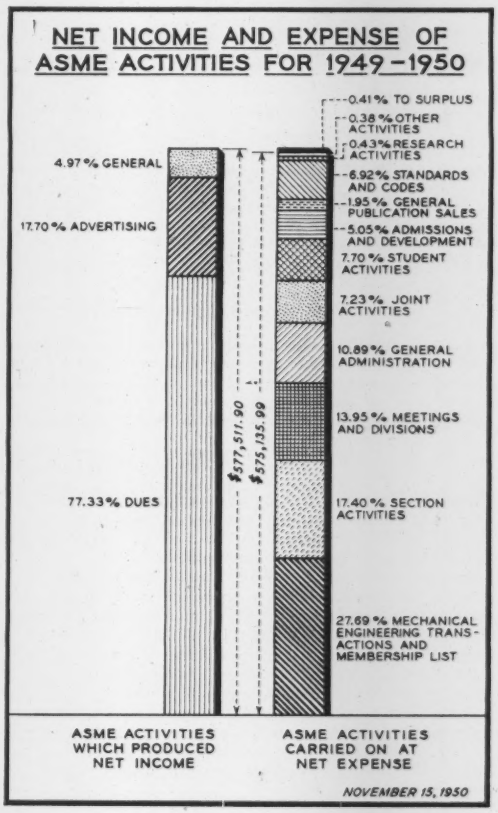


TABLE 4 INCOME AND EXPENSE FOR MAJOR GROUPS OF SOCIETY ACTIVITIES

	Expense	Income	Net	Expense per member	Income per member	Net expense per member
Dues	...	$ 446,606.53	$446,606.53	...	$13.01	...
General income (interest, discount, emblem sales, Engineering Index)	...	28,714.27	28,714.27	...	0.84	...
Publications, Standards, Codes, and Research	$ 775,151.67	663,638.61	111,513.06	$22.58	19.33	$ 3.25
General Society Activities (meetings, sections, student branches, admissions, etc.)	314,815.02	57,989.00	256,826.02	9.17	1.69	7.48
General Society Administration (council, auditor, counsel, retirement fund)	62,828.00	...	62,828.00	1.83	...	1.83
Joint Activities (Library, ECPD, EJC, etc.)	41,777.81	...	41,777.81	1.22	...	1.22
Additions to surplus from operating income	2,375.91	...	...	0.07	...	0.07
Total	$1,196,948.41	$1,196,948.41	...	$34.87	$34.87	$13.85
Addition to surplus from initiation fees		24,280.00				
Total addition to surplus		26,655.91				

TABLE 5 INCOME AND EXPENSE OF ASME ACTIVITIES
1949–1950

Activities Which Produce a Net Income		
Mechanical Engineering and Mechanical Catalog advertising income	$433,344.89	
Less production costs, wages, and indirect	331,153.79	$102,191.10
Engineering Index, Inc.		2,998.81
Miscellaneous Sales		7,513.54
Interest and Discount		18,201.92
Membership Dues		446,606.53
Total		$577,511.90
Activities Carried on at a Net Expense		
Mechanical Engineering text (production, wages, and indirect)		$116,545.85
Transactions (production, wages, and indirect)		35,021.16
Membership List (production, wages, and indirect)		8,398.21
General Publications Sales income	$ 80,249.68	
Stock cost, wages, and indirect	91,537.30	11,287.62
Standards and Codes income	$146,506.70	
Stock cost, wages, and indirect	186,449.69	39,942.99
Research income	$ 3,537.34	
Stock cost, wages, and indirect	6,045.67	2,508.33
Student dues	$ 55,713.00	
Student expense (production, wages, and indirect)	100,182.27	44,469.27
Meetings income	$ 2,276.00	
Costs, wages, and indirect	53,748.53	51,472.53
Sections (appropriations, travel, wages, and indirect)		100,499.32
Divisions (appropriations, wages, and indirect)		29,038.42
Admissions and Development (wages and indirect)		29,158.85
Awards (costs, wages, and indirect)		1,687.63
Engineers Civic Responsibility		500.00
Joint Activities		41,777.81
General Administration		62,828.00
Total		$575,135.99
Net Income		$ 2,375.91

1950 ASME ANNUAL MEETING

Brief Report of Outstanding Events at Hotel Statler, New York, Nov. 26–Dec. 1, 1950

IN the wake of a severe storm which crippled many areas of the northeastern portion of the country and delayed transportation schedules, the Seventy-First Annual Meeting of The American Society of Mechanical Engineers got under way on Sunday, Nov. 26, 1950, and continued through Friday of that week with headquarters at the Hotel Statler, and with a parallel attraction, the 19th National Power Show, under ASME auspices, in progress at the Grand Central Palace. Total attendance at the ASME Annual Meeting from preliminary figures stood at 5000.

A substantial Annual Meeting program schedule of 108 pages listed the numerous and varied events offered during the week. These included 79 technical sessions, 13 public luncheons and dinners, and a host of other events, such as Council and committee meetings, plant-inspection trips, college reunions, the schedule of entertainment provided by the Woman's Auxiliary, the list of exhibitors at the Power Show, the program of the American Rocket Society, affiliated with ASME, and a list of the 180 available preprints of papers.

The general pattern of the meeting followed that which has been in effect during recent years. The meeting of the Executive Committee of the Council, scheduled for Sunday morning, had to be postponed owing to late arrival of storm-bound trains and was actually held on Monday morning. The Council met at luncheon on Sunday and held its first session during the afternoon. Sunday evening was devoted to a general meeting of the Council with representatives of the Sections and Society committees at which engineering man power and efforts to establish greater unity in the engineering profession were discussed. Technical sessions opened on Monday morning and ran through Friday with sessions every morning, afternoon, and evening except Wednesday and Friday, when there were no evening sessions.

At the Business Meeting on Monday official reports were presented and accepted, the results of the balloting on Constitutional amendments (one of which increases ASME dues as of Oct. 1, 1951) were announced, and the newly elected officers were introduced. On Monday noon A. W. Robertson, chairman of the Board of the Westinghouse Electric Corporation, delivered the Towne Lecture, "The Individual and Free Enterprise," before a large audience, from a speakers' table presided over by James D. Cunningham, president ASME, 1950, at which were seated the newly elected president, J. Calvin Brown, the ASME vice-presidents, and Mrs. Randall B. Purdy, president of the ASME Woman's Auxiliary. The Members and Students Luncheon took place in the ballroom on Thursday noon, as reported elsewhere.

Wednesday evening was given over to the Annual Dinner and Honors Night at which President Cunningham acted as toastmaster and President Brown performed his first public official act in bestowing the honorary memberships, medals, and other honors. Howard Coonley, Associate ASME, consultant to the National Security Resources Board, delivered the Annual Dinner address.

Further details of the events of the Seventy-First Annual Meeting will be found in these pages. It is impracticable to present a detailed report on the technical sessions and the contents and discussion of the long list of technical and general-interest papers. On pages 74–76 there appears a list of papers available in preprint form. Digests of these papers are to be found from month to month in the ASME Technical Digest Section of this magazine. A relatively few of the papers have or will appear in MECHANICAL ENGINEERING, while some others have been assigned to Transactions and the *Journal of Applied Mechanics*.

SUNDAY NIGHT CONFERENCE

The critical engineering man-power situation, a progress report on unity in the engineering profession, and the need for American engineers to exert their influence on the State Department in appointments to international engineering conferences, were the three topics discussed during an informal meeting of ASME Council, Boards, and Executive Committees of Professional Divisions and Sections held on Sunday evening, November 26, 1950. President James D. Cunningham presided.

ENGINEERING MAN POWER

How the nation was going to meet the competing demands of engineering man power already in short supply and sure to become worse in the immediate future was called the "most important problem to face the engineering profession in its history" by C. E. Davies, secretary, and member of the working committee of the 18-man EJC Engineering Man-Power Commission (See page 930 of the November issue of MECHANICAL ENGINEERING).

Mr. Davies said that the EJC Commission was organized at the request of the National Securities Resources Board, a top-level government body in charge of national planning. The NSRB not only was responsible for deciding the requirements of the Defense Establishment but also for the civilian economy and how that economy was going to keep the nation alive.

Early this summer, NSRB sent four identical letters to the EJC, the National Research Council, American Chemical Society, and American Institute of Physics, stating that in a national emergency it may be required to reserve engineering skills and to draft engineers on requisition from the Armed Forces. This would be a radical departure from selective-service practices of World War II and would introduce unprecedented problems. NSRB asked EJC and the other three organizations to recommend how best to do the job.

To meet the challenge posed by the letter, Mr. Davies said, EJC appointed its Engineering Manpower Commission composed of three top-level men from American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society of Chemical Engineers, and the American Society for Engineering Education. E. G. Bailey, past-president and honorary member ASME, was appointed temporary chairman. ASME representatives are George W. Codrington, General Motors Corporation, Carey H. Brown, Eastman Kodak Company, and Reginald E. Gillmor, Sperry Corporation.

The EJC Commission met for an all-day session on October 12, 1950, in the Engineering Societies Building, New York, N. Y., at which representatives of the other organizations addressed by the NSRB were present. A working committee was ap-

pointed to study the problems and to draft a statement. This working group has met several times, Mr. Davies continued. It was approaching its task from its most serious aspect—a situation of actual invasion of the United States. In doing so it had come across man-power realities that called upon the engineering profession for statesmanship of the highest order.

Three serious circumstances confront the committee, he stated: (1) Current plans for a 3,000,000-man army, requiring induction of 700,000 young men between 19 and 26, per year, threatens to absorb potential man power, leaving few for training in engineering schools; (2) diminishing enrollment in engineering schools will create an estimated shortage of 40,000 engineers by 1954; and (3) the report of an oversupply of engineers issued in the spring by the Bureau of Labor Statistics is turning young men away from engineering as a career.

Two other problems complicated the engineering man-power picture, Mr. Davies continued. Public opinion is generally in favor of universal military training. If UMT is enacted, it would remove from the schools and industry more young men who should be training for engineering jobs. The second factor, he said, was the ROTC program being considered to train men for the Army and the Air Forces. This program would pay qualified young men $50 to $60 a month and all instruction expense during a four-year course in an engineering school. On graduation these men would be lost to industry for two or more years. Because the program would drain off most of the men qualified for engineering careers, it poses a serious engineering man-power problem for industry which must produce for defense and civilian needs.

Mr. Davies reported that the EJC proposal would soon be presented to the Commission. If approved, it will be submitted to NSRB as a formal recommendation of EJC, he said.

ENGINEERING UNITY

E. J. Kates, ASME representative on the Exploratory Group on Unity of the Engineering Profession composed of representatives of 15 national engineering societies, reported on progress. (See pages 671–672 of the August issue of MECHANICAL ENGINEERING.) The following four plans for engineering unity were under consideration, he explained:

Plan A, EJC Plan: This contemplates the expansion of the Engineers Joint Council under its present institution.

Plan B, Modified EJC Plan: This proposes not only the expansion of EJC to include other engineering societies but also individual dues-paying members.

Plan C, Merger Plan: This contemplates the merger of EJC and the National Society of Professional Engineers into a single body.

Plan D, NSPE Plan: This plan proposes adoption of NSPE as the unity organization and expansion of its membership and activities through the co-operation of other engineering societies.

In the discussion which followed, considerable difference of opinion was expressed. Plan B was favored by some because of its individual dues-paying provision. D. Robert Yarnall, Fellow and past-president ASME, commented that one of the weaknesses of the former American Engineering Council was its lack of individual membership. "It failed," he said, "because it got too far away from the individual engineer."

Mr. Kates emphasized the exploratory nature of the studies being undertaken and explained that after the plans are reviewed by the main Exploratory Group, each representative would take them before his own society for full discussion.

INTERNATIONAL ENGINEERING APPOINTMENTS

Mr. Bailey reported that the State Department has under consideration appointment of a nonengineer to head the American delegation to a sectional meeting of the World Power Conference to be held in Delhi, India, in January, 1951. The appointment of nonengineers for such posts, he said, was a usurpation of responsibility which belongs to members of the engineering profession. A nonengineer in such an assignment reflects no credit on American engineering.

At the meeting of the Council earlier in the day, action was taken approving an ASCE resolution recommending to the Secretary of State appointment of Gail A. Hathaway, Mem. ASCE, special assistant to Chief of Engineers, War Department, Washington, D. C., as chairman of the U. S. delegation to the January meeting.

In asking members for approval of Council action, Mr. Bailey stated that EJC must exert itself by demanding responsibility for engineering appointments in the international field.

ASME COUNCIL MEETS

The Council of The American Society of Mechanical Engineers always has a busy time during the opening days of an ASME Annual Meeting in the performance of its official duties.

Owing to bad weather which interfered with transportation in the northeastern area of the United States, a meeting of the Executive Committee of the Council, scheduled for Sunday, had to be postponed until Monday morning. Members of the Council got together for their first session on Sunday afternoon. They were also present at a joint conference with Sections, Professional Divisions, and other committees held Sunday evening for the discussion of matters relating to engineering man power and greater unity in the profession. Monday morning saw them back at their official duties in a concluding session of the 1950 Council.

The President's Luncheon on Monday noon provided an opportunity for presenting the vice-presidents representing the eight regions to the members of the Society. Monday at 5 o'clock demanded the presence of the officers and members of the Council at the 1950 ASME Annual Business Meeting. Later that evening the Council Dinner was held at which the 1951 officers and newly elected members of the Council took over the affairs of the Society from the 1950 Council, thus inaugurating a new administrative year. For the newly elected members an "indoctrination" session was held in the Secretary's office on Tuesday morning, and the vice-presidents, under the direction of the newly elected president, J. Calvin Brown, engaged in a long and fruitful discussion of Society affairs and administration problems.

President Cunningham presided at the Sunday sessions of the Council, the Business Meeting, the Joint Conference, the concluding Council session Monday morning, the President's Luncheon, and the Members and Students Luncheon, and acted as toastmaster at the Annual Dinner.

ACTIONS OF THE 1950 COUNCIL

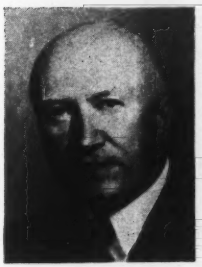
At the meeting of the 1950 Council, the Annual Reports of the Council, Boards, Committees, and Joint Activities, and the annual report of the Woman's Auxiliary were presented.

On pages 41 to 46 of this issue will be found the Annual Report to the members under the title "An Intensive Look at the 1950 ASME Year." This brief report summarizes the high points of ASME activities, presents statistical material related thereto, and contains a brief presentation of the finances of the year. The reports of the Boards, Committees, and Joint Activities have been brought together in a 60-page pamphlet which is available on request. The report of the ASME Finance Committee, a separate document, is also available.

The report of the Woman's Auxiliary showed a membership

New Members of the 1951 ASME Council

Regional Vice-Presidents



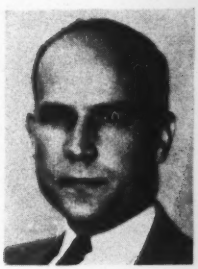
HENRY R. KESSLER

STEPHEN D. MOXLEY

CARL JOHN ECKHARDT

J. T. RETTALIATA

Directors at Large



LIONEL J. CUCULLU

HAROLD E. MARTIN

of 901 in eleven sections from coast to coast. It summarized the year's activities and contained a financial report. The Council extended a vote of thanks and sincere appreciation to the Woman's Auxiliary for its splendid work.

CONSTITUTION AND BY-LAWS

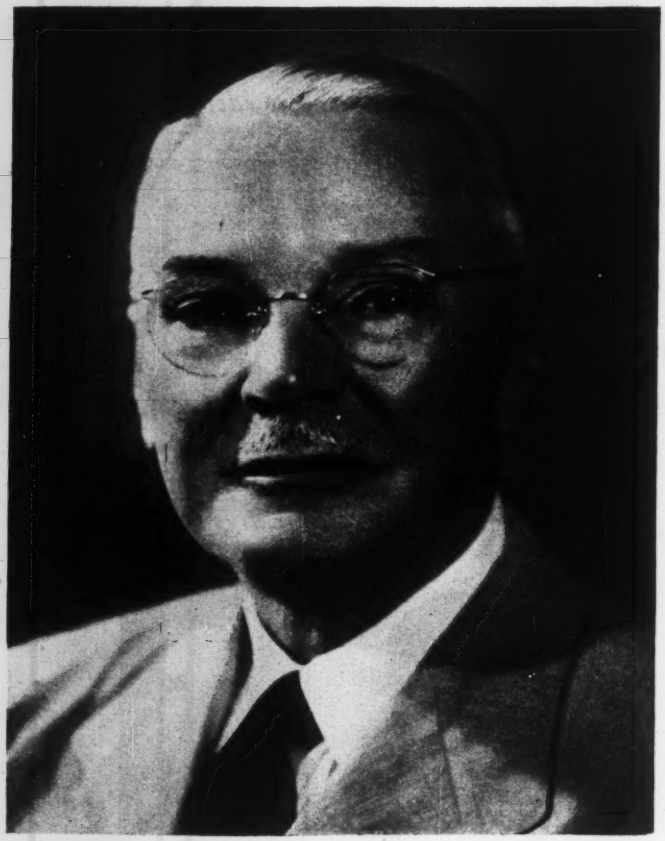
It was reported that the amendments to the Constitution which had been submitted to letter ballot of the members had been favorably received. The amendment to increase the dues had been passed by slightly more than the two-thirds majority required. The other amendments related to: (*a*) A requirement that "the Council shall consist of twenty-two members of the Society who have reached the grade of Member" (instead of "corporate members"); (*b*) clarification of the time of the first meeting of new Council ("promptly after the close of the business meeting during the Annual Meeting...."); and (*c*) stating the time of appointment of the Secretary and Treasurer.

Three amendments to the By-Laws were adopted: In Article B4, Par. 8, relating to the Medals Committee "the Board of Honors" is substituted for "the Council" as the agency to which the Committee makes its recommendations. The amendment to Article B6A, Par. 8, limits the period of service of a chairman of a Board or committee to three rather than five consecutive years, with the exception of the Boiler Code and Power Test Codes, in which cases the Council may approve extension annually. Article B7 Par. 8, election of officers and directors, is deleted because it is covered in the newly adopted amendment to Article C6, Sec. 2.

An amendment to the By-Laws relating to the status of the Safety Committee was presented for first reading.

UNITY OF THE ENGINEERING PROFESSION

Edgar J. Kates, who is ASME representative on an Exploratory Group on Unity of the Engineering Profession, presented a progress report. Mr. Kates said that the Exploratory Group consisted of the representatives of some fifteen national engineering societies which had been invited by the Engineers Joint Council to study the possibility of establishing an organization which would be able to speak for the profession. He emphasized the fact that the function of the Group was purely



James D. Cunningham

Retiring President of The American Society of Mechanical Engineers for 1950

exploratory and that a Planning Committee, of which he was a member, had been organized to consider specific suggestions for reporting to the entire Group. A meeting of the Group was scheduled for December to consider a report of the Planning Committee which Mr. Kates summarized for the information of the Council.

Four possible plans for increasing unity in the profession are to be presented to the main Group:

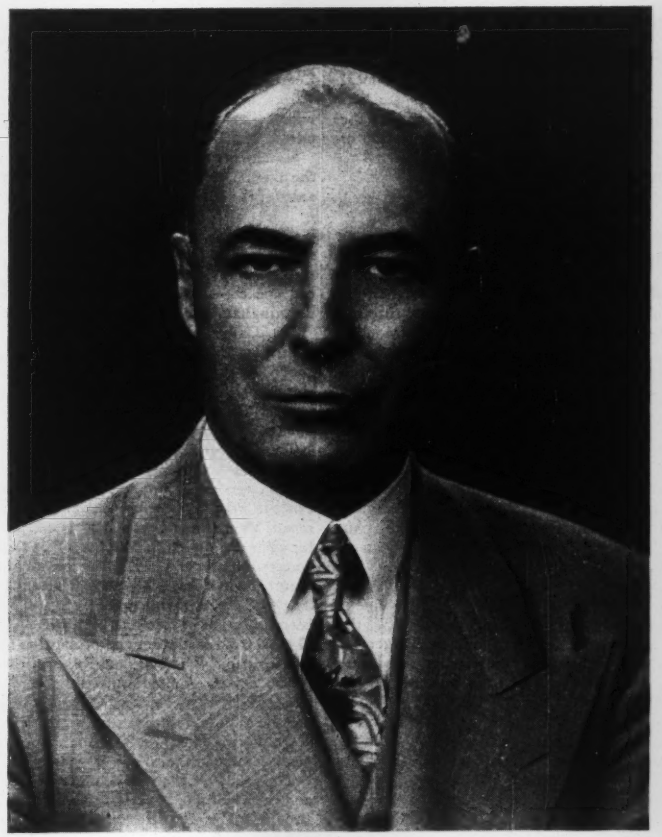
Plan A, the "EJC Plan," contemplates expansion of the Engineers Joint Council as it is now instituted, but with the inclusion of more engineering socities.

Plan B, the "Modified EJC Plan," proposes not only the expansion of EJC to include other engineering societies but also individual dues-paying members.

Plan C, the "Merger Plan," contemplates the merger of EJC and the National Society of Professional Engineers into a single body.

Plan D, the "NSPE Plan," proposes adoption of NSPE as the unity organization and expansion of its membership and activities through co-operation with other engineering societies.

The Council spent considerable time in discussion of Mr. Kates' report at its Sunday and Monday sessions and at the Joint Conference on Sunday night, as reported elsewhere. After the four plans are discussed by the Exploratory Group at the December meeting, a revised report, with background information, will be sent to the ASME Sections and ASME Vice-Presidents for discussion. Each society representative on the Exploratory Group will discuss the subject with his own society for the purpose of obtaining a full expression of opinion. Later, the Planning Committee proposes to reconvene the Exploratory Group for further discussion and, if possible, the recommendation of a single plan to the constituent societies.



J. Calvin Brown

President of The American Society of Mechanical Engineers for 1951

ENGINEERS JOINT COUNCIL

It was reported that EJC was seriously concerned by actions of the State Department in appointing as United States representatives to international engineering meetings and congresses men who were not engineers and not fitted properly to represent the engineers of the nation. An immediate case is to be found in a sectional meeting of the World Power Conference to be held in India, to which, it has been reported, a non-engineer is under consideration by the State Department as an official representative. At this meeting the incoming president of the American Society of Civil Engineers, Gail A. Hathaway of the Corps of Engineers, will be present and the EJC has asked the State Department to make him their representative.

The ASME Council voted to take parallel action and a letter to the State Department urging Mr. Hathaway's appointment was authorized.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

At its meeting in Cleveland the Engineers' Council for Professional Development approved a revised charter which was sent to the constituent societies for adoption, a necessary procedure since ECPD operates under a charter granted by those constituent societies. The charter revisions state the objects, program, and method of operation of ECPD in more definitive language than was used in the original charter. The ASME Council approved the new charter.

ECPD TRAINING PROGRAM

A. C. Monteith, at the Monday morning session of the Council, presented a brief summary of the proposed project of the ECPD Training Committee, of which he is the chairman, which seeks to organize at the community level a comprehensive training program to aid in the professional development of young engineers during the first five years after graduation.

More detailed explanation of the project will be found in the December, 1950, issue of MECHANICAL ENGINEERING. The project involves the hiring of an ECPD field secretary who will enter a previously studied community to assist in getting the local program under way. Implementation of the project demands funds to cover the expense, and these funds will come from the industries and the constituent societies. An appropriation of $3000 for support of the project was suggested and referred to the Finance Committee.

ASME STAFF

For several years the Council has called before it at the time of the Annual Meeting members of the Staff who have served the Society 25 years. These persons are introduced to the Council by the Secretary, who describes their work briefly, and they receive the thanks and the appreciation of the Council through the President. A check is handed to each. At the Monday morning session this year the following Staff members appeared before the Council: C. E. Davies, Miss Marie J. Mullan, Miss Leslie Scanlan, and Benjamin H. Theroux, 30 years of service; Miss Mary Fischer and Miss Jeannette M. Meyer, 25 years of service.

OTHER BUSINESS

The Council listened to a report on the nomination of George Westinghouse to the Hall of Fame. It authorized the President to appoint an ASME representative to the Seventy-Fifth Anniversary, Sept. 3–7, 1951, of the American Chemical Society. Actions of the Executive Committee were also reported.

MEETING OF THE EXECUTIVE COMMITTEE

At a meeting held on Monday morning, November 27, the Executive Committee approved revisions of the Budget for 1950–1951. Among the appropriations that were increased were those for meetings, MECHANICAL ENGINEERING text pages, Engineers' Council for Professional Development, and the International Standards Organization. Employment of investment counsel for the Finance Committee was authorized.

The Secretary was authorized to proceed with plans for a public-relations program for the Society.

Extensions of research agreements between the Society and the Battelle Memorial Institute, in one case, and the Massachusetts Institute of Technology in the other, were approved.

The establishment of an ASME Student Branch at the University of Toledo was authorized.

It was announced that the 1950 Kelvin Gold Medal had been awarded to Dr. Theodor von Kármán.

MEETING OF THE 1951 COUNCIL

The Council for 1951 met with the 1950 Council on Monday evening, November 27. Certificates were presented to retiring members of the 1950 Council and the special emblem of the past-presidents was bestowed on Mr. Cunningham. J. Calvin Brown, elected president for 1951, then took the chair.

C. E. Davies, Joseph L. Kopf, and Edgar J. Kates were reappointed secretary, treasurer, and assistant treasurer, respectively. Mr. Kopf was also reappointed treasurer of the ASME Development Fund.

The ASME Executive Committee for 1951 will be constituted as follows: J. Calvin Brown, chairman; Frank M. Gunby, vice-chairman; and Albert C. Pasini, Thomas E. Purcell, and William M. Sheehan, members.

The following assignments of directors at large to Boards and committees were made: Board on Codes and Standards, Benjamin P. Graves; Board on Education and Professional Status, Ralph A. Sherman; Board on Honors, Lionel J. Cucullu; Board on Membership, William M. Sheehan; Board on Public Affairs, Harold E. Martin; Board on Technology, Thomas E. Purcell; Finance Committee, Abbott L. Penniman, Jr. (with Past-President D. Robert Yarnall); Organization Committee, J. A. Keeth (with Past-President James D. Cunningham).

Two special committees of the Council were discharged with sincere thanks for their services: Gifts and Bequests Committee, and Lectureships Committee.

Statements of delegation of the authority of the Council to the Board on Technology and the Board on Codes and Standards for the period of one year were approved.

1950 ASME ANNUAL BUSINESS MEETING

The Annual Business Meeting of the ASME was called to order in the Keystone Room of the Hotel Statler by President Cunningham at 5 o'clock on Monday, November 27.

Mr. Davies announced that H. H. Snelling, who has not missed an ASME Annual Meeting in a quarter of a century, was confined to the hospital. A telegram expressing the appreciation of the Society for the services rendered to it by Mr. Snelling and the hope for his speedy recovery was authorized by a unanimous vote of the members.

The Secretary summarized the Annual Report of the Council (see pages 41–46 of this issue) and presented the reports of Committees to the Council and the annual financial statement. For the Finance Committee, H. E. Whitaker, chairman, presented the report of that committee. He said that the income for the year ending September 30, 1950, was the largest in the Society's history, $1,197,000. Major sources of income were: Membership dues, $446,000; gross advertising revenue, $433,000; gross publication sales, $230,000. Expenditures also had been heavy, but $2300 had been added to surplus in addition to $24,000 from initiation and promotion fees, as provided by the Constitution, By-Laws, and Rules of the Society.

Mr. Davies entered into the record certain statements as required by the Constitution and the statutes and a list of members added and those deceased during the year.

On motion from the floor the acts of the Council during the year were unanimously approved.

The report of the tellers of election of officers was presented and the new officers were declared elected. They are: J. Calvin Brown, president; Henry R. Kessler (Region II), Stephen D. Moxley (Region IV), J. T. Rettaliata (Region VI), and Carl John Eckhardt (Region VIII), vice-presidents to serve two years; and Lionel J. Cucullu and Harold E. Martin, directors at large to serve four years. All of the new officers present were introduced by Mr. Cunningham.

Amendments to the Constitution voted on by members during the year had been passed, Mr. Davies announced. These amendments include one providing for an increase in dues, to be effective October 1, 1951; one requiring members of the Council to be of Member or higher grade; one setting the time of the first meeting of the incoming Council "promptly after the Business Meeting," and one stipulating the time for the appointment of the Secretary and Treasurer.

PRESIDENTS' LUNCHEON

The Presidents' Luncheon on Monday, November 27, was the first public luncheon of the 1950 Annual Meeting. Some four hundred members and guests heard A. W. Robertson, chairman of the board, Westinghouse Electric Corporation, Pittsburgh, Pa., deliver the 1950 Towne Lecture on "The Individual and Free Enterprise." Retiring President James D. Cunningham presided.

Mr. Robertson was introduced by A. C. Monteith, chairman of ASME Education Committee, vice-president in charge of

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Here and There at the 1950 Annual Meeting

[(1) Frank M. Gunby, Vice-President ASME Region I; Forrest Nagler, Vice-President ASME Region VI, and Mrs. R. B. Purdy, retiring president ASME Woman's Auxiliary; (2) Mr. and Mrs. R. W. Worley and Mrs. J. Quaid; (3) John Morrow and Miss Mary Field; (4) Mr. and Mrs. R. A. North; (5) Mr. and Mrs. C. Jobst; (6) Bruce Barton and Glenn B. Warren at the Power Division Luncheon.]

engineering, Westinghouse Electric Corporation. The country was engaged in an ideological struggle between individualism and collectivism, Mr. Monteith said. If individualism is to triumph, he asserted, "engineers can no longer stay on the side lines."

In his opening remarks, Mr. Robertson expressed amazement that in a country like the United States where the fruits of free enterprise and individualism are so evident there should be any support of a collectivist ideology. He predicted that the mid-twentieth century would be judged by future generations as a "golden era" of material prosperity. This period, he said, was different from any other which has preceded it in our history.

Supporting the growth of collectivism in America, Mr. Robertson said, was a "colossal scientific ignorance" of the telephone, the electric light, and other technological miracles which most persons take for granted. The world was the product of free enterprise, yet most young people do not appreciate that fact. They seem to overlook the virtues of our economic system and exaggerate the effects of business cycles. The crash of 1929 has become a symbol distorted beyond recognition by detractors of free enterprise. Another factor working against individualism was the highly specialized nature of our society. The Jack-of-all-trades has disappeared forever.

In spite of these disturbing influences, Mr. Robertson was optimistic over the future. Men could always choose freedom, and in America freedom and opportunity could be found in large corporations as well as in the small business.

The Towne Lecture honors Henry Robinson Towne, ASME president in 1889, whose paper "The Engineer as an Economist" initiated a flow of valuable Society contributions on scientific management.

ANNUAL DINNER

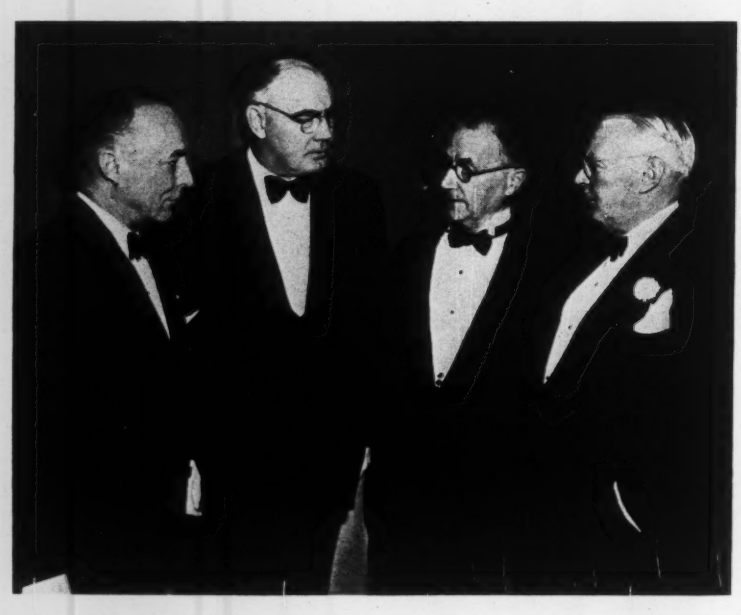
Wednesday of the Annual Meeting is the traditional time when the Society pauses in its program of technical discussions to confer honors and awards on the distinguished members of the profession, on the young men who have shown proficiency in their chosen profession, and the leaders in the profession who have added to the richness of American life.

More than 1400 members and guests of The American Society of Mechanical Engineers witnessed the colorful ceremonies in the ballroom of the Hotel Statler.

Retiring President James D. Cunningham, Fellow ASME, was toastmaster. Mr. Cunningham extended a welcome to distinguished guests from foreign countries and officers of the United Engineering Trustees, Engineers' Council for Professional Development, Engineers Joint Council, and sister societies who were asked to rise and receive the applause of the audience.

Referring to the Society's international activities, Mr. Cunningham introduced James A. Vance, president, Engineering Institute of Canada, who conveyed greetings and best wishes of his organization. Oliver V. S. Bulleid, Hon. Mem. ASME, and past-president of The Institution of Mechanical Engineers, also said a few words about his pleasure in visiting the United States for the first time. He expressed the "affectionate regard" of the IME for the ASME, and the "everlasting love" of his native land, Ireland, for the United States.

Mr. Cunningham next introduced the newly elected members of Council and the president. They are: *vice-presidents*, Henry R. Kessler, ASME Region II; Stephen D. Moxley, ASME Region IV; John T. Rettaliata, ASME Region VI; Carl J. Eckhardt, ASME Region VIII; *directors at large*, Lionel J. Cucullu, New Orleans, La., and Harold E. Martin, New York,



J. CALVIN BROWN, 1951 ASME PRESIDENT; JAMES A. VANCE, PRESIDENT OF THE ENGINEERING INSTITUTE OF CANADA; O. V. S. BULLEID, PAST-PRESIDENT OF THE INSTITUTION OF MECHANICAL ENGINEERS OF GREAT BRITAIN, AND JAMES D. CUNNINGHAM, 1950 ASME PRESIDENT

N. Y.; *president*, J. Calvin Brown, Los Angeles, Calif. Mr. Cunningham then introduced President Brown who spoke briefly. Mr. Cucullu was not present to receive the applause of the audience.

"We have with us tonight," Mr. Cunningham continued, "a number of members who have completed 50 years of membership during this year." He asked the following members to stand and receive the special 50-year membership button of the ASME: William Henry Boehm, Dexter Simpson Kimball, Gerhardt J. Patitz, Adrian O. Van Dervort, and Elmer E. Wood. M. L. Pusey accepted the button for his father-in-law Edwin E. Arnold, who was unable to be present.

The following members who were not present, Mr. Cunningham explained, would receive similar recognition at appropriate occasions in their own community: Charles Louis Bauer, James M. Brown, John Rowland Brown, William Darbee, Edward A. Deeds, Ernest F. Du Brul, Norman J. Gould, Charles O. Gunther, Elmer K. Hiles, T. W. Johnson, Gompei Kuwada, Richard K. Le Blond, Ralph D. Mershon, Alex W. Moseley, Ernest H. Peabody, Frederick L. Pryor, William S. Speed, Paul C. Van Zandt, James A. White, and Alpheus Fuller Williams.

Mr. Cunningham then asked members in the room who had 50 years or more of membership to rise and receive the applause of the audience. He called attention to the work of the Old Guard Committee who, under the leadership of Frederick D. Herbert, Fellow ASME, who received a 50-year badge last year, aided ASME student and junior members.

"If the Society had a Section in Sweden," Mr. Cunningham said, "it would have been able to honor one of its loyal members last year by presenting one of the Society's gold cards signifying the attainment of 35 years of membership." This member, Alex Engblom of Sweden, Fellow ASME, was present and, Mr. Cunningham said that the Society was taking this occasion to recognize his loyalty publicly. Mr. Engblom arose and received his gold card from Mr. Cunningham.

HONORS AND AWARDS

Turning next to the presentation of honors and awards, Mr. Cunningham explained that the following student and junior awards would be presented at the Members and Students Luncheon on Thursday, Nov. 30:

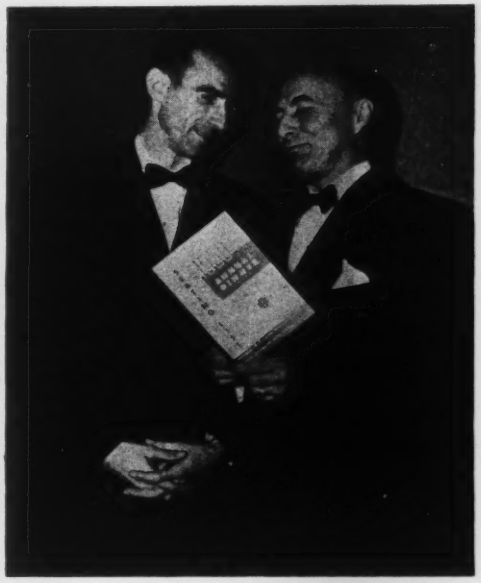
Undergraduate Student Award to James Norris Colebrook (University of Cincinnati) for his paper "The Design and Construction of a Pressure Transducer Testing Machine."

Charles T. Main Award to Richard Thomas Johnson (University of Detroit) for his paper "The Need for Conversion to a Five-Year Course in Engineering Instruction for the Bachelor's Degree in Order to Include Additional Instruction in Public Relations."

Mr. Cunningham introduced Reinout Pieter Kroon, 1950 recipient of the Spirit of St. Louis Medal. Mr. Kroon is manager of Engineering Gas Turbine Division, Westinghouse Electric Corporation. He received the medal at the 1950 Semi-Annual Meeting in St. Louis, "for engineering leadership in the development of aviation gas turbines."

The Spirit of St. Louis Junior Award was also presented at St. Louis, he said, but the recipient, Harry Ansoff, was unable to be present. Mr. Ansoff won the award for the paper, "Stability of Linear Oscillating Systems With Constant Time Lag."

The Pi Tau Sigma Gold Medal award established in 1930 to recognize outstanding accomplishments of young mechanical engineers less than 10 years out of school and under 35 years of age was presented to Arthur Paul Adamson, Jr. (University of Southern California), Mem. ASME, and an engineer of the General Electric Company. Presentation was made by Prof. F. L. Schwartz of the University of Michigan, and president of Pi Tau Sigma.



WINS 1950 UNDERGRADUATE STUDENT AWARD

(James N. Colebrook (*left*) of Cincinnati, Ohio, junior member of ASME, winner of the Undergraduate Student Award for his paper "Design and Construction of a Pressure Transducer Testing Machine," receives the congratulations of J. Calvin Brown, 1951 ASME President.)

The Richards Award, sponsored jointly by Pi Tau Sigma and ASME to honor a mechanical engineer for noteworthy achievement within 20 to 25 years after graduation, was presented to Burgess Hill Jennings (The Johns Hopkins University), Fellow ASME, for his contribution as author, engineer, and consultant in the fields of refrigeration, air conditioning, and engineering education.

With the assistance of Ernest L. Hopping, chairman of the Board on Honors, and three marshals, Dean A. A. Potter, Clarke Freeman, and Warner Seely, Mr. Cunningham continued with the honors ceremony. As the awards were announced the marshals escorted recipients to the center of the dais where the citations were read and each received from President Brown certificates or medals as the awards provided. The following awards were presented:

The Melville Medal for original work to Samuel Jasper Loring, Mem. ASME, consulting engineer, Hamilton Standard Propeller Division, United Aircraft Corporation, East Hartford, Conn., for his paper "A Theory of the Mechanical Properties of Hot Plastics."

The Worcester Reed Warner Medal to Orland William Boston, Fellow ASME, Director of the Department of Metal Processing, College of Engineering, University of Michigan, for his contributions to the art of cutting metals which have improved productivity of American industry and stimulated broader research and enrichment of engineering education.

The Holley Medal to Charles Gordon Curtis for his contributions to the steam turbine and to the field of gas-turbine power. The medal honors Alexander Lyman Holley who presided at a meeting in 1880, at which plans for the formation of ASME were made. George I. Rockwood, Hon. Mem. ASME, es-

BURGESS H. JENNINGS, *(left)* PROFESSOR AND CHAIRMAN OF THE DEPARTMENT OF MECHANICAL ENGINEERING, NORTHWESTERN UNIVERSITY, RECIPIENT OF THE RICHARDS MEMORIAL AWARD FOR "OUTSTANDING ACHIEVEMENT IN MECHANICAL ENGINEERING WITHIN 20 TO 25 YEARS AFTER GRADUATION"; J. CALVIN BROWN, 1951 ASME PRESIDENT; ARTHUR P. ADAMSON, GENERAL ELECTRIC COMPANY, ENGINEER, WHO RECEIVED THE PI TAU SIGMA GOLD MEDAL FOR "OUTSTANDING ACHIEVEMENT IN MECHANICAL ENGINEERING WITHIN TEN YEARS AFTER GRADUATION"; AND PROF. FRANK L. SCHWARTZ OF THE UNIVERSITY OF MICHIGAN, PRESIDENT OF PI TAU SIGMA

tablished the award in 1923 to honor those who by some "great and unique act of genius of an engineering nature have accomplished a great and timely benefit." Mr. Rockwood, who was an honored guest, was introduced by Mr. Cunningham.

The ASME Medal to Harvey Coles Knowles, vice-president in charge of purchases, Procter and Gamble Company, for his successful application of continuous production processes to the loading of explosive ammunition with resultant great savings in time and cost.

HONORARY MEMBERS

Proceeding to the Honorary Members, Mr. Cunningham explained that the Constitution of the Society provides that an honorary member shall be a person of acknowledged eminence. Over the past 70 years, he said, leaders of engineering and professional life throughout the industrial world have been among those selected for this honor. This year the engineers so honored are: Oliver Vaughan Snell Bulleid, consulting mechanical engineer to the Irish Transport Undertaking, Dublin, Ireland; Harold Vinton Coes, Fellow and past-president ASME, consulting engineer, New York, N. Y.; Lillian Moller Gilbreth, Fellow ASME, president, Gilbreth, Inc., Montclair, N. J.; Harry Miller Pflager, Fellow ASME, St. Louis, Mo.; Frederik Ljungstrom, Sweden. Mr. Ljungstrom was unable to be present but was represented by Gunnar Hambraeus, Scientific Attaché of the Swedish Ambassador to the U.S. Mr. Hambraeus would arrange a suitable occasion in Sweden for the presentation of the certificate of Honorary Membership to Mr. Ljungstrom by the American ambassador to Sweden, Mr. Cunningham said.

Following the honors ceremony, Howard Coonley, consultant, National Security Resources Board, Washington, D. C., spoke on "The Role of Conservation in Mobilization Planning."

As part of its all-out drive for conservation, Mr. Coonley said, the National Security Resources Board was planning to re-create the Conservation Co-ordinating Committee which operated during the last war. According to Mr. Coonley, the Committee would include representation of all three divisions of the Department of Defense, the Munitions Board, the National Production Authority, and other Government agencies that had a major concern with materials.

Mr. Coonley said the setting up of this committee was the most important activity that would be undertaken by the National Security Resources Board in the vital field of conservation. Declaring that conservation was not an American characteristic, he said that we lacked "a spirit of thrift." He added, however, that it should not require a war or even a threat of war to make us aware of the necessity to save.

"Our people have ingenuity, adaptability, and driving power," he said, "but we are not by nature accustomed to make much out of little to see how far we can stretch the cloth which is within easy reach."

In the present crisis, said Mr. Coonley, conservation was the ingredient that would "expand the output of our mills and our machinery—that urgently important additional amount which is needed to take care of civilian as well as military require-

GEORGE I. ROCKWOOD, DONOR OF THE HOLLEY MEDAL; J. CALVIN BROWN, 1951 ASME PRESIDENT; AND CHARLES G. CURTIS, 90-YEAR-OLD PRESIDENT OF THE INTERNATIONAL CURTIS MARINE TURBINE COMPANY OF NEW YORK

(Mr. Curtis, who was awarded the Holley Medal for "inventions of great public benefit," invented the Curtis steam turbine in 1896 and the first American complete gas-turbine power plant.)

J. CALVIN BROWN (*center*), 1951 ASME PRESIDENT; AND (*left to right*) O. V. S. BULLEID, CONSULTING MECHANICAL ENGINEER OF DUBLIN, EIRE; DR. LILLIAN M. GILBRETH, NOTED MANAGEMENT ENGINEER; HARRY M. PFLAGER OF ST. LOUIS, MO., INVENTOR AND ENGINEER, NOTED FOR HIS CONTRIBUTIONS TO THE STEEL INDUSTRY; AND HAROLD V. COES, EXECUTIVE VICE-PRESIDENT, NATIONAL MANAGEMENT COUNCIL, NEW YORK, WHO WERE MADE HONORARY MEMBERS OF THE ASME

J. CALVIN BROWN, 1951 ASME PRESIDENT, PRESENTS THE WORCESTER REED WARNER MEDAL TO ORLAND W. BOSTON, PROFESSOR AND CHAIRMAN OF THE DEPARTMENT OF METAL PROCESSING, UNIVERSITY OF MICHIGAN, FOR HIS "LASTING CONTRIBUTIONS TO THE ART OF CUTTING METALS."

ments, and thereby safeguard our republic and assure the survival of the democratic nations of the world, whether our destiny be the terrors of another war or the blessings of long years of peace."

Conservation in mobilization planning might be divided into six broad categories, he said. They were: (1) Standardization, specifications, and simplification; (2) measures to determine and safeguard supplies of critical materials; (3) development of substitutes wherever necessary and possible; (4) salvage and savings at the source; (5) cataloging of supplies under a system of standard identification to avoid duplication and waste; and (6) international co-operation in conservation measures.

Mr. Coonley said the NSRB was giving "every encouragement" to the Standards Agency of the Munitions Board in its work of reviewing several of their standards for drawings and drafting-room practices and planning an expansion of these standards. He said the NSRB could conceive of "no conservation measure that would prove of greater value to the mobilization effort than a unified set of industrial-military standards in this important area."

"Had there been available in World War II such a group of standards, millions of dollars and hundreds of thousands of skilled man-hours would have been saved," he declared.

The text of Mr. Coonley's address will be found on pages 3–4 of this issue.

At the conclusion of Mr. Coonley's talk, Mr. Cunningham closed the dinner meeting, after which a reception was tendered to the presidents and their wives. Dancing followed in the Georgian Room.

DINNERS AND LUNCHEONS

"The Engineer and His Civic Responsibility," the theme of the 1950 Annual Meeting, was the subject of a talk given by Bruce Barton of Batten, Barton, Durstine and Osborne, Inc., New York, N. Y., at the luncheon of the Power Division on Tuesday, Nov. 28.

The first civic responsibility of the engineer, Mr. Barton said, was the same as that of every other educated citizen, mainly to think, to hear both sides of every public issue and have his own judgment, to insulate himself against propaganda, to refuse to let inherited prejudices dominate his reasoning, to be undisturbed in finding himself repeatedly in the minority, and to seek to contribute something new in the way of seasoned opinion rather than accept opinion formulated by self-appointed "leaders."

Mr. Barton said that practically no scientific thinking was being done about war and that this was a subject to which the trained minds of engineers might well be addressed. He posed such questions as these: Why have there always been wars? What are the underlying causes of wars? What can be done to remove the deep-down tensions and pressures that finally erupt into war?

There were many answers to these questions, Mr. Barton continued, but in substance they add up to practically nothing.

Mr. Barton reviewed the major wars of the world and stated that while some of the past wars may have been profitable to the victors in a territorial sense, no future wars will again be profitable in the one world of today. He referred to the book, "The Revolt of the Masses," by the Spanish philosopher, José Ortega y Gasset, who pointed out that for twelve centuries from the sixth to the beginning of the 19th the population of Europe remained constant at 180,000,000 inhabitants and that in the ninteenth century Europe's population leaped to 460,000,000. The book points out, he stated, that future wars will be more

THE ASME MEDAL FOR DISTINGUISHED SERVICE IN ENGINEERING

(J. Calvin Brown, 1951 ASME President, and Harvey C. Knowles, recipient of the ASME Medal, highest honor of the Society. Mr. Knowles is vice-president of the Procter and Gamble Defense Corporation of Cincinnati, Ohio.)

SAMUEL J. LORING (*left*) RECEIVES THE MELVILLE PRIZE MEDAL FOR THE "BEST ORIGINAL PAPER OR THESIS ON ANY MECHANICAL-ENGINEERING SUBJECT PRESENTED BEFORE THE ASME THE PREVIOUS YEAR" FROM J. CALVIN BROWN, 1951 ASME PRESIDENT, AS CLARENCE E. DAVIES, ASME SECRETARY, LOOKS ON

and more wars of the masses—total wars instead of the former small operations fought for remote objectives.

Mr. Barton pointed out that because the United States was engaged in making food plentiful and living conditions healthier "all over the world," we were subsidizing overpopulation in many areas already dangerously overpopulated and, in a sense, strengthening the causes of war. Countries with fast-mounting populations tend always to be "aggressor countries," Mr. Barton asserted.

The truly alarming multiplication of the world's masses, Mr. Barton concluded, was one of the pressures that united to cause war. What the world needs, he said, was the kind of analytical and nonpolitical study of war that would seem to be most natural and rewarding to the scientific minds of engineers.

RESEARCH VERSUS SMALL BUSINESS

In a talk which he gave on "Research Versus Small Business," Sherwood B. Seeley, director of research, Joseph Dixon Crucible Company, Jersey City, N. J., explained that "by research I mean the scientific and technical endeavors of professional people in industry; by small business, I mean small in thinking and planning—not necessarily small in dollars sales volume. Versus means against. So there we have it, scientific thinking against small thinking, limited thinking, or channeled thinking." Mr. Seeley's talk was delivered at the Wood Industries Luncheon on Tuesday.

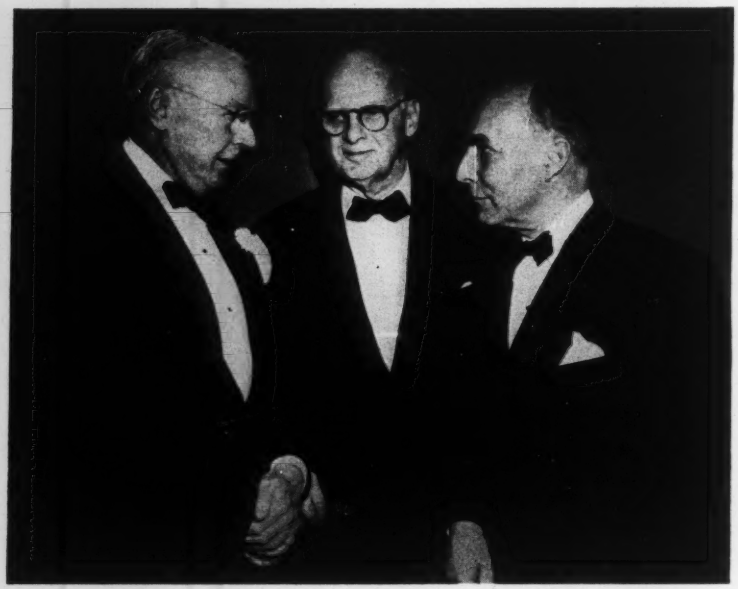
Even in more enlightened and modern organizations, said Mr. Seeley, the director of research and development must be ever so careful to get his program integrated into the company; not only into the company plans and policies but into its personalities as well. Consider the plight of the poor engineer who develops a new process only to find that management will not spend the money for equipment, the superintendent will not approve the new process, and sales will not stand for a change in the product.

He emphasized that research and development cannot effectively be directed— or dictated to— by management. Technologists must be directed by one of their own kind who has a comprehensive understanding of scientific and engineering methods coupled with sound business judgment and a true understanding of company needs. He must understand the executive thinking but must be courageous in dealing with management. The research and development administrator must be thoroughly acquainted with company policy and must fence off a little sphere where freedom of thought and intellectual honesty can be exercised. He should direct his plans at the business over the horizon with the aid of assessed facts—not hunches and guesses. He must see that these plans are well integrated into management, sales, and manufacturing policies. He must carefully prepare the entire organization to use the completed development, keeping in mind differences in personalities and manner of thinking (just as any good salesman does). He must bridge the gaps to realize he is now dealing with people.

Charles R. Nichols, Jr., Mem. ASME, Joseph Dixon Crucible Company, Jersey City, N. J., presided.

INDUSTRIAL ECONOMY OF BRITAIN

Great Britain is in desperate need of a revival of personal religion to prevent the rapid growth of communistic fervor in its troubled youth, W. R. Woolrich, Fellow ASME, dean of engineering at the University of Texas, declared at the Industrial Instruments and Regulators Division luncheon on Tuesday.



JAMES D. CUNNINGHAM, 1950 ASME PRESIDENT, HOWARD COONLEY, CONSULTANT TO THE NATIONAL SECURITY RESOURCES BOARD, WHO SPOKE AT THE SOCIETY'S ANNUAL DINNER, AND J. CALVIN BROWN, 1951 ASME PRESIDENT

Dean Woolrich said "active religion" is Britain's greatest need for permanent economic recovery.

He pointed out that in the scientific field they surpass the Americans in fundamental and basic investigation and research. The puzzle to most of them is why Americans, who trail them in basic scientific attainment, so far outdistance them in the applied sciences and in technological productivity.

Were he "commissioned" to chart Britain's future course, Dean Woolrich said he would recommend certain changes which, he cautioned, would have to be "promoted with great caution to prevent any untoward individual hardships."

Recently returned from a year's stay in the British Isles, Dean Woolrich said that there were too few altars of responsive religion in the land, and too often the small group present exhibited no appreciable zeal for their faith; whether the edifice was Anglican, Roman Catholic, or one of the dissenting religions, the experiences were too often the same.

These events, he stated, together with the current statistics on British church membership and attendance, and our own observations on the evidences of the breakdown in the morality of the youth, convinced us that Britain's number-one need for permanent economic recovery was a revival of personal religion.

Dean Woolrich said he would recommend the following observations:

(1) That for building a permanent civilization on their present trembling structure, a free-enterprise system must be made the incentive to their thousands of small industries. Great Britain's prosperity has been built up on a foundation of a host of small business enterprises and her present welfare-state controls are rapidly forcing these small holders either to closure or into combinations. Britain's decay will closely follow the closing of her small industry.

(2) As soon as possible, Britain should expand her small industry to an increased production of precision and high-quality goods. Her colonies and dominions with their newly acquired "know how" will rapidly take over the production of many of the simpler crafts and by their acquired earning capacity will then be in the market for precision and quality goods. With much of the production of Austria and Eastern Germany at a low level, Britain could enter the precision field with her excellent system of scientific and technical training and research.

(3) Britain should place more of her advanced scientific students in universities of other leading nations of the world. She has been so self-sufficient in her scientific educational system that she needs a new freshness of creative education. Even Norway, with its population of fewer than three million people, has more students of a university level in the United States than has Great Britain with sixteen times as great a population. Furthermore, the great influx of Indian, Turkish, Egyptian, and South American students into the United States to learn the American "know-how" should be a warning to Great Britain that her customers of old are soon to become her high potential competitors.

(4) At least ten millions of Britain's young people should be encouraged to immigrate into Australia, Canada, British Africa, the Union of South Africa, or the United States. If part of the present population were spread out over this world-wide area, it would be a great commercial asset to Great Britain and relieve her of a population congestion that is becoming more serious each generation. Britain's present limitation on emigration of her subjects by insisting that they leave most of their assets in Britain is a shortsighted policy for the future of the British Isles and the commonwealth of British nations.

As part of the dinner program the IIR Division honored Clesson E. Mason, technical director, Bristol Company, Waterbury, Conn., "for his contributions to the theory and practice of industrial process control." Mr. Mason was presented a certificate of appreciation, an award which the IIRD plans to bestow annually on a man who has advanced the industrial-instrument art.

H. L. Mason, Mem. ASME, chairman IIRD, and a research professor of mechanical engineering at the Iowa State College, Ames, Iowa, presided over the luncheon.

SWEAT-COOLED ROCKET ENGINES

"Sweat-cooled" rocket and jet engines capable of higher speeds than ever may be in the offing for the U. S.

Rocket and jet engines are being pushed to such high capacity these days that one of the big problems is maintaining surfaces cool enough so that the metals will not be heat-damaged. "Hotter" engines are desirable however, because higher gas temperatures mean greater speeds and better fuel efficiency in jet engines, Allan P. Colburn Mem. ASME, provost of the University of Delaware, told ASME members and guests in attendance at the Heat Transfer Luncheon on Tuesday.

Many cooling methods are under consideration and one of the means being studied is sweat-cooling. In sweat cooling, he said, liquid is forced through the metal, either through transverse holes or porous parts of the metal. The liquid then vaporizes on the hot surface of the metal.

The calculation of heat transmission involves diffusion of the vaporized liquid counter to the direction of the conduction of heat, Provost Colburn said.

The effect of the vaporized liquid on the surface friction also involves an important factor to be studied, he added.

Provost Colburn cited an alternative cooling means. This is by use of a liquid used well below its boiling point. Since the metal surface may be well above the boiling point of the coolant, local boiling is involved.

He said a great deal of work is under way at the National Advisory Committee for Aeronautics on heat transmission to turbine blades and means for cooling them. They may be cooled, he said, by internal coolants as air, water, or other liquids, but problems of superimposed free and forced convection are encountered.

Another possibility cited by the speaker for securing higher fuel efficiency was by the use of very efficient heat exchangers. He said much work is under way in this direction.

Presiding at the luncheon was G. A. Hawkins, Mem. ASME, of Purdue University, Lafayette, Ind.

APPLIED MECHANICS DINNER

The annual Applied Mechanics Division Dinner which was held on Tuesday, was highlighted by an address on "Men and Development in Applied Mechanics," given by Jesse Ormondroyd, Mem. ASME, University of Michigan, Ann Arbor, Mich. In addition, Lloyd H. Donnell, Mem. ASME, Illinois Institute of Technology, Chicago, Ill., as incoming chairman, reviewed the work of the Division during the past year. He cited the publications problems regarding the overabundance of technical papers and also pointed out that the forthcoming First U. S. National Congress of Applied Mechanics to be held in Chicago, June 11–16, 1951, should absorb some of the papers which otherwise would be presented before ASME. This, plus the fact that the Applied Mechanics Division has canceled its 1951 summer conference, will alleviate the situation somewhat regarding the number of papers to be published.

Martin Goland, Mem. ASME, Midwest Research Institute, Kansas City, Mo., the new editor of *Applied Mechanics Reviews*, then briefly outlined the future plans for AMR. Beginning in January, 1951, a monthly lead survey article to be written by outstanding men in the various fields of applied mechanics will be included. Articles have already been submitted by Professor J. P. Den Hartog on "Vibration," and by Dr. Hugh L. Dryden on "Turbulence." Progress is also being made in reducing the backlog of reviews so that early next year AMR will be completely topical. Other changes include a new cover design, a new title page, and some type-style changes in the text pages.

Mr. Ormondroyd, who was the principal speaker, traced the history of applied mechanics from the time of such fundamental discoveries as the wheel and the pulley, down through the ages, citing the early works of Aristotle, who wrote three treatises on the science of motion; the work of Archimedes on which the laws of hydrostatics are based; and the work of Galileo in dynamics and elasticity in whose time modern science began. Between Galileo and Newton, Mr. Ormondroyd pointed out, the whole science of dynamics and the many other branches of applied mechanics gained recognition.

He discussed Newton's Laws and his "Principia," and the the work of Smeaton who prepared a series of experiments for the Royal Society of London on change in motion, kinetic energy, etc.

Other men and their work which Mr. Ormondroyd reviewed included Coulomb, Rankine, Carnot, Meyer, Joule, and Einstein.

R. P. Kroon, Mem. ASME, manager of engineering, Aviation Gas Turbine Division, Westinghouse Electric Corporation, Philadelphia, Pa., acted as toastmaster.

HYDRAULIC DINNER

After two days of technical sessions which attracted capacity audiences, the Hydraulic Division climaxed its Annual Meeting program with its traditional Hydraulic Old Timers Dinner on Tuesday, Nov. 28. The dinner was an informal affair

ERNEST HARTFORD (*left*), EXECUTIVE ASSISTANT SECRETARY, ASME, AND JAMES D. CUNNINGHAM, 1950 ASME PRESIDENT

without the usual ceremonies. Its main purpose was to give members an opportunity to meet one another in an atmosphere of joviality and good fellowship. Irl C. Martin, president, Woodward Governor Company, Rockford, Ill., was host.

GAS TURBINE POWER LUNCHEON

"The crisis we face today came about as a result of our failure five years ago to recognize our enemy." With these words George V. Denny, Jr., founder and moderator of "America's Town Meeting of the Air," started his realistic and interesting talk, entitled "Public Events and Public Opinion." The address was presented before the Gas Turbine Power, Aviation, Oil and Gas Power Divisions, and the Institute of Aeronautical Sciences and the Society of Automotive Engineers, on Wednesday, November 29.

Mr. Denny went on to state that the fear, gloom, and despair the world has been plunged into could be dispelled by some straight thinking. He stressed collective security, human relations, and particularly the need to "know" our enemy. He spoke at length about the United Nations and the present crisis in Korea, which he underscored in describing the enemy—our enemy and the enemy of freedom-loving peoples everywhere—as having begun the war against us long before World War II. It was a war to destroy our influence, to discredit us, and to turn the minds and hearts of the rest of the world against us and everything we stand for. These weapons may well prove to be more effective than guns, tanks, and planes, especially if we continue to play this diplomatic game of "striped pants" with them.

He suggested that each one should express his thoughts to his Congressmen and Senators so that public opinion will be known regarding public events. Then the meeting was opened to discussion. The group was fortunate indeed in having Admiral E. M. Zacharias, retired naval intelligence officer, to answer many of the questions from the floor.

Dean J. T. Rettaliata, Illinois Institute of Technology, acted as toastmaster.

MANAGEMENT LUNCHEON

At its annual luncheon on Wednesday, Nov. 29, the Management Division heard D. B. Mitchell, Sylvania Electric Products, Inc., New York, N. Y., describe his company's experience in operating in small-plant units. Mr. Mitchell was introduced by Dr. E. H. Hempel, Mem. ASME.

Except for five of its plants, Mr. Mitchell said, all have less than 1000 employees. The smallest plant has 230 employees and the largest 2900. Operating in small-plant units was made a policy of his company after the benefits experienced during the last war when a number of feeder plants were called upon to help his company's larger factories to meet the sudden load of war orders. In general, local plant managers run their own show while the headquarters office in New York acts in a planning and consulting capacity.

From his experience, Mr. Mitchell said, there were no tools of management enjoyed by big-plant management that were not available to management of smaller plants. Mr. Mitchell emphasized that managers of small plants have to be good all-round men because they could not afford "an army of specialists." One advantage of decentralization as practiced by his company was the opportunity it gives to its managers to grow into bigger jobs. Referring to community relations, Mr. Mitchell said that the philosophy of his company could be summed up in the phrase "We want to be neighbors." Simply because they may be large employers of local labor does not mean that they want to run the town. Because of its neighbor philosophy, Sylvania does not believe in taking advantage of a community by asking for special concessions.

In conclusion, Mr. Mitchell said that public policy demanded that no one company become so dominant in any field as to be able to control its market. For small business, he predicted a fine future in this country but added that the consuming public will demand just as good performance and just as low a price from the small as from the large producer. It is essential that small plants be just as alert to modern management practices and just as ready to invest in modern methods and facilities for improving products and reducing cost.

H. B. Maynard, Mem. ASME, president, Methods Engineering Council, Pittsburgh, Pa., presided at the luncheon. As retiring chairman, Mr. Maynard reviewed three projects in which the Management Division was interested. He referred to the recent publication of the book, "Small Plant Management," which, he said, was conceived and brought to a successful conclusion by E. H. Hempel, professor, Graduate School, Polytechnic Institute of Brooklyn, member of the faculty, Management Institute, New York University. The book was a major contribution of the Management Division to management on the small-plant level. The second project concerned riders to several appropriation bills now before Congress which would prohibit use of time-study methods in plants working under government contracts. Mr. Maynard warned that passage of these riders would be tantamount to national suicide. The third important aspect of the Division's work was its international activities. Mr. Maynard introduced L. Austin Wright, secretary of The Engineering Institute of Canada, who was a guest at the speakers' table. He also called attention to the Ninth International Management Congress in Brussels, Belgium, June 5–11, 1951, which the Division was supporting through the National Management Council. Mr. Maynard urged members to attend this important event because new management material would be presented for the first time. Mr. Maynard then turned the meeting over to Gideon M. Varga, Mem. ASME, vice-president, S. G. Yulke Company, New York, N. Y., and lecturer, Industrial Engineering Department, Columbia University, who is the incoming chairman. Mr. Varga presented to Mr. Maynard a certificate of award honoring his service as chairman of the Division.

In recognition of his achievement in conceiving and producing "Small Plant Management," Mr. Varga presented a framed certificate to Dr. Hempel on behalf of the Division.

FUELS LUNCHEON

Synthetic fuel processes can play an important part in meeting requirements for strategic chemicals used in the manufacture of such essential products as synthetic rubber, plastics, and nylon, said James Boyd, director of the U. S. Bureau of Mines, principal speaker at Thursday's Fuels luncheon.

Current shortages and increasing requirements for benzene, phenol, toluene, and certain other chemicals could accelerate the schedule for constructing the initial coal-hydrogenation plants, in view of the fact that these chemicals would be produced from such plants in important quantities, he said.

A Bureau of Mines study has determined that a coal-hydrogenation plant could be operated in such a manner that the yields of benzene, toluene, and xylenes would be increased by about 25 per cent. Mr. Boyd added, however, that this would result in a proportionate reduction in the yield of gasoline.

Many other products are obtainable from coal, but there is no present demand for them because they have never been produced in quantity. Many of these can be recovered by minor process changes, he continued.

Shale oil contains significant amounts of aromatic chemicals now in short supply, said Mr. Boyd. The Bureau of Mines has demonstrated in a laboratory unit that benzene and toluene can be obtained from oil shale by a radiant retorting process. If

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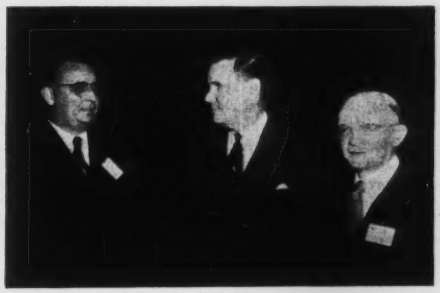

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Random Shots at the 1950 Annual Meeting

[(1) E. E. Wood; F. D. Herbert and G. W. Bacon, members of the ASME Old Guard; (2) T. D. Perry, Sherwood B. Seeley, C. R. Nichols, F. F. Wangaard, and F. P. Forbes at Wood Industries Luncheon; (3) Fred L. Hunt, A. C. Rhodes, G. L. Truitt, F. H. Fuller, and C. L. Westendorf, all of the engineering staff of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.; (4) H. B. Maynard, D. B. Mitchell, and E. H. Hempel at the Management Division Luncheon; (5) R. P. Kroon, Hans Jacob Reissner, Jesse Ormondroyd, and L. H. Donnell at Applied Mechanics Division Dinner; (6) A. C. Monteith, A. W. Robertson, and President J. Calvin Brown.]

this same process is commercially feasible in large-scale equipment, the yields of these two chemicals would be "quite impressive."

While pointing out the necessity of studying the fuel pattern as a whole, rather than any one fuel industry, in order to obtain a true picture for policy making, Mr. Boyd said that the trend in technology is toward expanding the area of interfuel competition, either by introducing new devices for utilization or by increasing knowledge of converting the various fuels into forms usable in present-day equipment. An example of the developing technology of the former type is the gas-turbine locomotive burning pulverized coal. The synthetic fuels illustrate the latter.

In surveying the United States' fuel supply, Mr. Boyd stated that the reserves of petroleum are relatively limited. The present decade is one in which authorities in both the petroleum industry and government have indicated that domestic petroleum production probably will pass its peak and may begin to decline.

These authorities, he said, anticipate that this decade will witness the birth and initial development of a new basic industry engaged in producing synthetic liquid fuels, first from natural gas, then from oil shale and coal.

Barring unexpected developments in atomic or solar energy, he continued, the anticipated gap widening between domestic demand and supply will have to be met by synthetic liquid fuels and imports. It is obvious that the security of our liquid-fuels position will be greatly enhanced when the supply is based in part on solid fuels, such as coal and oil shale, which comprise more than 95 per cent of our proved fuel reserves.

As part of the luncheon program, Oliver F. Campbell, Mem. ASME, chief combustion engineer, Sinclair Refining Company, East Chicago, Ind., was awarded an ASME Fellow certificate by J. Calvin Brown, president, ASME. Elmer J. Kaiser, member of ASME, outgoing chairman of the Fuels Division, and assistant director of research of the Bituminous Coal Research, Inc., Columbus, Ohio, acted as toastmaster.

AMERICAN ROCKET SOCIETY DINNER

The American Rocket Society, an affiliate of The American Society of Mechanical Engineers since 1945, held its fifth Annual Convention on Thursday and Friday, Nov. 30–Dec. 1, 1950.

The ARS technical program consisted of three technical sessions at which 12 papers covering theory, operation, testing, and design of rockets were discussed.

High light of the ARS Annual Convention was the Honors Night Dinner held on Thursday, November 30. This gave members from the various sections an opportunity to honor men who have made significant contributions to rocket research and others who have served the society well. William L. Gore, retiring president ARS, was toastmaster. He introduced the following members who were honored by election to the Fellow grade of ARS membership. They are: Fritz Zwicky, research consultant, and member of the advisory board, Aerojet Engineering Corporation, Azusa, Calif.; M. J. Zucrow, professor of gas turbines and jet propulsion, Purdue University, Lafayette, Ind.; G. Edward Pendray, senior partner, Pendray and Company, New York, N. Y.; Louis G. Dunn, director, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif.; and Rear Admiral Calvin B. Bolster, assistant chief and deputy of naval research, Navy Department, Washington, D. C.

FRITZ SWICKY AND W. L. GORE AT HONORS DINNER OF AMERICAN ROCKET SOCIETY

The following honors were conferred:

The 1950 ARS Student Award to Clair M. Beighley, research assistant, Purdue University, Lafayette, Ind., and Eldon L. Knuth, Guggenheim Fellow, California Institute of Technology, Pasadena, Calif., for a paper judged to be the best presented to the ARS Award Committee.

The C. N. Hickman Award to Col. Leslie A. Skinner, in recognition for his vision and achievement in the development and application of weapons utilizing solid-propellant rockets, his part in aiding in the successful development of the famous Bazooka in World War II. Colonel Skinner was not present to receive the award because of illness in his immediate family. E. C. Uhl, coholder of the original Bazooka patent, accepted the award for Colonel Skinner.

The Robert H. Goddard Memorial Lecture Award to Lovell Lawrence, Jr., president, Reaction Motors Inc., Dover, N. J. for "initiative and vision in the research and development of liquid rocket power blades." The award was presented by Mrs. Robert H. Goddard, whose late husband the award memorializes.

Following the presentations, Mr. Gore announced a new ARS Award to be called the G. Edward Pendray Award. It would be conferred for the first time, he said, in 1951, and would give recognition to an author for significant contributions to the literature of rocket and jet-propulsion engineering.

The main speaker of the evening was Dr. Fritz Zwicky, who spoke on the subject "Tasks We Face." Dr. Zwicky recommended a new method of thought which he called morphological thinking. The goal of the new method was the visualization and analysis of all possible solutions of any given problem without regard or reference to standards of value. Dr. Zwicky claimed for the proposed method the virtue of opening up vistas to the inquiring mind—vistas which, he said "remained hidden to unorganized thought which leaves invention to chance."

Dr. Zwicky reported that historically the first application of the morphological method in a systematic and complete way was to the problem of determining the totality of all jet engines which were composed of simple elements and activated by chemical energy. The method resulted in some 17,000 possible simple engines. Out of this number, 576 jet engines composed of simple elements, were listed.

Even such a colossal problem as the reconstruction of the planetary system might not deter the morphologist. Using the power of nuclear fission, Dr. Zwicky said he could visualize a tremendous lopsided explosion which could be set up to bring the planets into the earth's orbit. There would be one danger though, he said, tongue in cheek, poor or malicious handling of the operations might cause the earth to explode. But for the true morphologist to explode the earth by mistake would be poor form indeed, he concluded.

TECHNICAL PROGRAM

More than 200 technical papers were presented during the 83 sessions held at this year's ASME Annual Meeting, thereby disseminating a vast fund of technological information to engineers and to industry in general. For example, in the field of steam power, besides studies on furnace-performance factors and boiler feedwater, a report on the first application in a 30,500-ton super-tanker using 1020 F steam, was given. In railroads, a progress report on the Alco-G-E gas-turbine electric locomotive was given; and a discussion centered about the development of special freight cars designed for protection of lading. A symposium was also conducted on the question of how effective the use of double-screen locomotive fuels has been. Another panel considered the problems encountered in burning heavy fuel oil with respect to attack of metals at high and low temperatures, and fouling of tube banks.

In the aviation field, turbo-jet engine installation problems and the design of turbojet engines for supersonic speeds, were covered. Automation and quality control were featured in production engineering. In metals engineering, papers covering direct chill casting and continuous casting were given. As part of the hydraulics program a special round-table session was devoted to a discussion of our present state of knowledge regarding cavitation and cavitation damage. Operating and performance experience with five residential heat-pump installations using air as the heat source were presented during a process-industries meeting. The latest developments in rubber and plastics field were discussed in a symposium on rubber and plastics gaskets and packing.

In a series of papers, the management division surveyed the small-plant management field with emphasis on economics, techniques, and the new engineering problems which decentralization of big business and the growth of small producing units has introduced. Also discussed at a management session was the significance of the General Motors—United Automobile Workers five-year contract. Another symposium in education explored what is wrong with the way fuels and fuels utilization are taught in the schools and industry.

Continuing an innovation started last year, the Aviation and Materials Handling Divisions of ASME in joint sponsorship with the Institute of Aeronautical Sciences and the Society of Automotive Engineers again held Air Cargo Day on Tuesday of the meeting. It was an all-day affair which included the presentation of technical papers on air-cargo developments including aircraft and ground-handling facilities and exhibits by the major airlines and aircraft manufacturers participating in air-cargo developments. The exhibits included models and photographs of the latest air-cargo planes and ground facilities.

Other fields covered at the Annual Meeting were industrial instruments, fluid meters, heat transfer, applied mechanics, oil and gas power, wood industries, textiles, properties of gas, metal cutting, cutting fluids, machine design, safety, petroleum, lubrication, and the effects of temperature on the properties of metals.

Pages 74–76 contain a list of the preprints that were made available at the Meeting. The list is arranged according to divisions and committees. In the ASME Technical Digest section of this issue of MECHANICAL ENGINEERING, 58 digests of Annual Meeting preprints appear. Digests of any remaining Annual Meeting preprints will be published in the ASME Technical Digest section of forthcoming issues of MECHANICAL ENGINEERING.

Pamphlet copies of the preprints are available from the ASME Order Department, 29 West 39th St., New York 18, N. Y. When ordering please give title, author, and paper number. Price, 25 cents per copy to ASME members.

AIR-CARGO EXHIBITS IN THE FOYER OF THE KEYSTONE ROOM AT THE ANNUAL MEETING

STANDARDIZATION ACTIVITIES

Committees engaged in preparation of codes and standards held 37 meetings during Annual Meeting week. Of these the Sectional Committee on Code for Pressure Piping released their revised edition B 31.1 for approval by the American Standards Association. A new edition of the elevator code will be ready by summer.

The Standardization and Safety Committees announced approval of 29 standards and codes during the fiscal year ending October 1, 1950. Among these were standards for milling cutters, involute splines, involute serrations, 20-deg involute and straight bevel gears and safety codes for industrial power trucks and manlifts.

It was reported that industry had rapidly accepted the 1950 Unfired Pressure Vessel Code and that over 10,000 copies had been distributed to date. Work is progressing on several new sections of this code relating to clad, high-alloy, nonferrous, and cast vessels. A co-ordinated effort is now under way to standardize qualifications for welders working on boilers, pressure piping and flanged fittings, and the several committees are seeking to unify requirements for stress allowances and other details common to the individual codes.

INSPECTION TRIPS

On Monday morning, November 27, a group of ASME members and guests inspected the Hires Beverage Company, in Brooklyn, N. Y. Their visit covered the entire production of Hires Root Beer, from bottle washing, filler, conveyer, packing, and shipping.

In the afternoon the ASME toured the Brooklyn Union Gas Company, in Brooklyn, N. Y., where they saw a modern manufactured-gas plant of about 160,000,000 cu ft daily capacity. A mixed gas is sent out containing coke-oven gas, carbureted-water gas, producer gas, and oil-refinery gas. In addition, liquefied petroleum gas is stored for use in emergencies and for peak loads. By-products, such as, coke, coal tar, ammonium sulphate, motor fuel, and water-gas tar are obtained in normal operation.

The Elevator Division of Westinghouse Electric Corporation, in Jersey City, N. J., played host to ASME members and guests on Tuesday morning. This plant manufactures elevators and electric-stairway equipment with the exception of the motors. The group saw how the electric controllers are made through all its phases of manufacture. They also saw how the door operators and various stairway and elevator machines are made and also visited the area where the compressors are manufactured. Entire phases of operation on compressors for air-conditioning systems were seen.

ASME BOOTH AT 1950 POWER SHOW

The Continental Baking Company (Wonder Bread Plant) in Hoboken, N. J., was inspected in the afternoon. The ASME group visited the mixing and fermentation process departments. They witnessed the dividing and molding of individual dough pieces and final bake, the collecting of the individual baked loaves of bread, the slicing and wrapping, and preparation for final packing into hampers for truck distribution. The steam pipe oven is 100 ft long × 9 ft wide, and heated by means of enclosed pipes. Capacity of plant is predicated upon oven capacity of 55 loaves of bread per minute.

On Wednesday morning, ASME members and guests were treated to a preview of the West Side Bus Terminal, in New York City. The terminal opened officially on December 14, 1950. The group visited the world's largest and most modern bus terminal, constructed under the direction of the Port of New York Authority at a cost of approximately $24,000,000. The terminal was built to relieve traffic congestion on the West side and to provide a centrally located, spacious and comfortable union station for approximately 130,000 passenger movements resulting from the daily arrival and departure in Manhattan of 2500 intercity buses.

The American Machine and Foundry Company, Brooklyn, N. Y., was host to the ASME on Wednesday afternoon. Here a group witnessed the making of cigar and cigarette machines, cigarette packing machines, special sewing machines similar to hand sewing, bread-wrapping machines, and automatic drill chucks.

The Lincoln Tunnel was visited on Thursday morning by an ASME group. They were taken through the Lincoln Tunnel to the New Jersey Ventilation Building where they saw the control room, ventilation system (fans), and air analyzers.

Also on Thursday morning members and guests of ASME previewed the new United Nations Headquarters, East River Drive, New York City. The official opening is scheduled for this month.

In the afternoon an ASME group toured the Board of Transportation of the City of New York. They visited the Generating Division of the Power Department of the City's Subway System.

Also on Thursday afternoon, another ASME group toured the Lionel Corporation, Irvington, N. J. Here they saw the manufacture of Lionel trains and accessories from raw material. A visit to departments making die castings, stampings, plastic moldings, powdered-metal parts, finishing, assembly, and testing, was on the program.

COLLEGE REUNIONS

Sixteen colleges and universities took advantage of the fact that so many mechanical engineers were in New York City for the 1950 ASME Annual Meeting to hold reunions all over the city. Groups of engineers met in the Engineers' Club and at luncheon and dinner meetings held in popular eating places around the city. Reunions were held by the following schools: Brown University, Clarkson College, The Cooper Union, Cornell University, Georgia Institute of Technology, Harvard University, University of Illinois, University of Michigan, University of Missouri, Northeastern University, Oregon State College, Purdue University, Rensselaer Polytechnic Institute, Stevens Institute of Technology, Worcester Polytechnic Institute, and Yale University.

POWER SHOW

This year the National Exposition of Power and Mechanical Engineering, popularly known as the National Power Show, was held under the auspices of The American Society of Mechanical Engineers in its traditional location in Grand Central Palace, New York, N. Y., concurrently with the Annual Meeting. Over 300 exhibiters occupied three floors showing the latest equipment used in every phase of the mechanical-engineering field. The ASME booth was located near the entrance of the exhibition hall and was visited by many members who attended the Show.

One of the features was an educational exhibit sponsored by the ASME Heat Transfer Division and the Technical Committee of Tubular Exchanger Manufacturers Association. The exhibit was co-ordinated with a symposium on mechanical-engineering design problems in heat exchangers sponsored by the Heat Transfer and Applied Mechanics Divisions. The exhibit consisted of 12 heat-exchanger models, each with cutaway sections to expose interior design. Models were contributed by various member companies of TEMA and in all cases were especially prepared for exhibit purposes.

In addition to a variety of shell-and-tube heat exchangers, a

deep pipe heat exchanger of the thin design was on exhibit along with one style of air-cooled heat exchanger which are currently winning acceptance for use in dry areas.

COMMITTEES IN CHARGE

Meetings of The American Society of Mechanical Engineers come under the general supervision of the Committee on Meetings and Programs. The technical program is provided by the Society's professional divisions and technical committees. Other features are planned and supervised by committees organized within the Metropolitan Section. In grateful acknowledgment of the many committees whose efforts contributed so substantially to the success of the 1950 Annual Meeting their personnel is listed in what follows:

Meetings Committee: Allen W. Thorson, chairman, R. E. Peterson, Robert H. Bacon, J. Keith Louden, Willis F. Thompson, with J. C. Parmely, Raymond H. Tolman, L. F. Zsuffa, C. L. Huey, associates, and Robert C. Spencer and Glenn R. Fryling, junior advisers.

Board on Honors: Ernest L. Hopping, chairman, Benjamin P. Graves, director at large, Clarke Freeman, Ely C. Hutchinson, Paul E. Holden, and Warner Seely.

Medals Committee: Ernest L. Hopping, chairman, Joseph B. Ennis, Sr., Clarke Freeman, Benjamin P. Graves, Eugene W. O'Brien, Harry R. Westcott, Tomlinson Fort, Ely C. Hutchinson, Morrough P. O'Brien, Robert M. VanDuzer, Jr., L. M. K. Boelter, Paul Holden, R. J. S. Pigott, Ralph R. Turner, J. Stanley Morehouse, L. F. Nenninger, Gerald V. Williamson, Lionel J. Cucullu, Alfred Iddles, Warner Seely, and Frank Prouty.

Annual Dinner Committee: C. F. Beckwith, chairman, W. L. Betts, vice-chairman, J. T. Costigan, J. W. Bennett, and John T. Robinson.

Inspection Trips Committee: R. W. Flynn, chairman, A. T. Kniffen, G. E. Hagemann, and M. O. England.

Committee on Women's Activities: Mrs. F. W. Miller, honorary chairman, Mrs. C. H. Kent, general chairmen, Mrs. Sabin Crocker, general vice-chairman, and Mrs. Crosby Field, publicity chairman, Mrs. George W. Nigh, Mrs. F. W. Miller, Mrs. T. A. Burdick, Mrs. H. R. Kessler, Mrs. Sabin Crocker, Mrs. A. M. Feldman, Mrs. W. E. Case, Mrs. U. A. Rothermel, Mrs. E. A. Lundstrom, and Mrs. N. F. Dahl.

Ushers: W. L. Betts, J. T. Costigan, and Glenn R. Fryling.

Committee on Student Aides: Honorary chairmen of Metropolitan colleges, Fred P. Burns, Clarence Anderson, Edward A. Bogucz, Leroy S. Olsen, William H. Roberts, Jr., William H. Ruten, Matthijs Boissevain, David D. Acker, and John A. Damm.

Nineteenth National Power Show Advisory Committee: Irving E. Moultrop, chairman, consulting engineer, John H. Lawrence, vice-chairman, consulting engineer, Lester T. Avery, president, American Society of Heating and Ventilating Engineers, John G. Bergdoll, Jr., president of American Society of Refrigerating Engineers, James D. Cunningham, president of The American Society of Mechanical Engineers, C. E. Davies, secretary, The American Society of Mechanical Engineers, Chester R. Earle, managing editor, *Power Engineering*, David Moffat Myers, consulting engineer, Joseph Pope, vice-president, Stone and Webster Engineering Corporation, L. N. Rowley, Jr., chairman, Board on Technology, The American Society of Mechanical Engineers, Ralph A. Sherman, director at large, The American Society of Mechanical Engineers, A. Bowman Snavely, chief engineer, Hershey Chocolate Corporation, Philip W. Swain, editor, *Power*, and Willis F. Thompson, vice president, Westcott & Mapes, Inc.

JAMES D. CUNNINGHAM, 1950 ASME PRESIDENT, C. E. DAVIES, SECRETARY OF THE SOCIETY, AND J. CALVIN BROWN, 1951 PRESIDENT OF THE SOCIETY

ASME HONORS ENGINEERS

Biographies of Recipients of Honorary Membership and Awards at the 1950 ASME Annual Meeting

EVERY year The American Society of Mechanical Engineers honors distinguished members of the engineering profession by the presentation of certificates of honorary membership and the prizes and awards that have been instituted from time to time during the course of the Society's existence. The bestowal of these certificates, prizes, and awards is a colorful feature of the ASME Annual Dinner where the attendance this year exceeded 1400 persons. A description of the dinner and a list of the recipients of honorary-membership certificates, prizes, and awards will be found on other pages of this issue. In the following pages brief biographies are presented so that members of the Society may know what manner of men they have honored, and how signally they have honored their Society by recognizing outstanding and specific achievements.

HONORARY MEMBERS

OLIVER V. S. BULLEID

OLIVER VAUGHAN SNELL BULLEID, consulting mechanical engineer, Coras Iompaire Eireann (Irish Transport Undertaking) Dublin, Eire, was nominated by the ASME Railroad Division as the outstanding railway-equipment engineer and executive of Great Britain.

He was born in 1882 at Invercargill, New Zealand, and attended Spa College, Bridge of Allen, Scotland; the Municipal Training School, Accrington; Doncaster Technical School and night courses at Leeds and Sheffield Universities. Beginning as an apprentice in 1901 at the Doncaster Works of the Great Northern Railway, by 1906 he was assistant to the locomotive works manager.

In World War I he was commissioned major when he became Deputy Assistant Director of Transportation for army units in the field and, returning to England, was works manager at Richborough until demobilized. Resuming railroading, he advanced to the position of chief mechanical engineer of the Southern Railway of Great Britain in 1937. He was responsible for many innovations in locomotive and car design that contributed to smoother running and less frequent overhauling. Notable among his developments are the "Merchant Navy" and "West Country" types of high-capacity light-weight locomotives.

During World War II Mr. Bulleid was chairman of the Mechanical and Electrical Engineers' Committee of the British Railway Executives. In 1905 he became adviser to the Minister of Transport on reconditioning rolling stock after the war.

Mr. Bulleid has served on the British Standards Institution many years and is a member of the Permanent Commission of the International Railway Congress Association. He was president of the Institution of Locomotive Engineers 1939–1944 and president of The Institution of Mechanical Engineers in 1946.

HAROLD V. COES

HAROLD VINTON COES, born in Hyde Park, Mass., in 1883, and president of ASME in 1943, has spent the most fruitful years of his life in applying the objective principles of engineering methods to the complex problems of industrial management and finance and thereby has restored many engineering and manufacturing enterprises to economic health.

To a sound engineering education acquired at M.I.T., with a degree of BS in 1906, he added several years of engineering practice which developed his talents for financial and industrial management. In 1917, as a member of the staff of Gunn, Richards, and Company, industrial engineers, he reorganized munition plants in Canada. His success led to an invitation to join the staff of Ford, Bacon, and Davis, Inc., to assist in the design of munitions and other wartime plants in the United States.

From 1924 to 1928 he was director, vice-president, and general manager of the Belden Manufacturing Company of Chicago, but he returned in 1928 to Ford, Bacon, and Davis, Inc., as manager of the industrial department. In 1937 he became a partner of that firm, a vice-president in 1941, and a director in 1943. On behalf of his firm, he engaged actively in the management of several industrial concerns. From October, 1945, to April, 1946, he was a consultant, representing his company, to the Planning and Development Department of the Government of India.

Although Mr. Coes retired in 1948, retirement has merely shifted his activities to other fields of consulting practice. In 1949 he served a tour of duty in Europe for ECA, and in 1950 he was CIOS consultant to UN Economic and Social Counsel. He has been active in ASME affairs for many years, and in numerous other engineering and management societies, and in civic affairs.

LILLIAN M. GILBRETH

LILLIAN MOLLER GILBRETH, eminent engineer, author, educator, humanitarian, lecturer, and counselor born in Oakland, Calif., was graduated from the University of California in 1900 and received a master's degree there in 1902. In 1915 she received the degree of PhD from Brown University. She is known at home and abroad not only for her technical contributions to engineering in the field of management techniques but also for her work in developing the engineering approach to human relations.

Dr. Gilbreth has been active as partner and later as president of Gilbreth, Inc., since 1904. With her late husband she initiated techniques in the field of motion study and in the development of skills. She has done creative and pioneering work in applying motion study and scientific planning to agriculture and the home. She has applied her talents to the retraining of disabled veterans. She has occupied the posts of professor of management at Purdue University, of chairman of the Department of Personnel Relations, Newark College of Engineering, and of lecturer on the effects of engineering on human relations all over the world.

A member of ASME since 1926, Dr. Gilbreth was made a Fellow in 1945. She is an honorary member of the American Management Association, and the Society for the Advancement of Management.

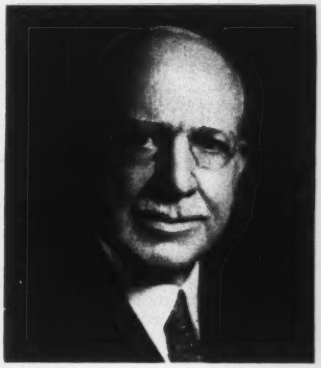
With her late husband, Dr. Gilbreth was awarded the Gantt Medal in 1944. She was acclaimed the "Woman of the Year" in 1948 by the American Women's Association, and received the Gold Medal of the National Institute of Social Sciences in 1949. Honorary degrees have been conferred on her by the University of Michigan (1928), Rutgers University (1929), Russell Sage

Made Honorary Members of the ASME

HAROLD VINTON COES
Honorary Membership

LILLIAN MOLLER GILBRETH
Honorary Membership

OLIVER VAUGHAN SNELL BULLEID
Honorary Membership (1949)



HARRY MILLER PFLAGER
Honorary Membership

FREDRIK LJUNGSTROM
Honorary Membership

College (1931), Brown University (1931), University of California (1933), Temple University (1948), Stevens Institute of Technology (1950), and Smith College (1950).

FREDRIK LJUNGSTROM

FREDRIK LJUNGSTROM, whose fertile mind has conceived ingenious and practical solutions of an amazing variety of mechanical-design problems, was born in Stockholm, Sweden, in 1875. Robbed by ill health of a formal engineering education, he learned from practice in his father's geodetic-instrument shop and by self-instruction.

A foreman in his brother Birger's bicycle factory in 1894, later an employee of the famous Alfred Nobel, and of Dunfield and Elliott's, Newcastle, he designed a light, high-efficiency boiler with pump-controlled circulation in the high-pressure zone and steam generation at lower pressure. From 1899 to 1905 he experimented with a milking machine of his own design. His great contributions to the steam-power plant were made during the years 1905 to 1925. He first materially aided his brother Birger in developing the radial double-flow steam turbine. In 1917 he developed a 2000-hp steam-turbine locomotive equipped with a condenser and in 1918 the air-preheater which bears his name.

On his own again in 1925, he designed the first variable-gear clutch for motor cars, a gasoline engine which was cooled by its own lubricating oil, and a vibration-proof single-cylinder oil engine for fishing boats. In 1940, for the Swedish Government, he devised a method of extracting fuel from shale by sinking electrically heated rods into it in a circle and allowing the oil and gas to escape by a central tube under their own pressure.

Since 1946 he has concentrated his efforts on improvements in sailing craft, aiming at a return of the sailing ship as a practical device for fishermen and freight carriers.

Dr. Ljungstrom has received high honors in Sweden and Germany and was awarded the James Watt International Medal of The Institution of Mechanical Engineers for 1949.

HARRY M. PFLAGER

HARRY MILLER PFLAGER, pioneer in the development of large integral castings for railway and industrial service, was born in St. Louis, Mo., in 1866.

While receiving his early education at the St. Louis Manual Training School and while he was a student in mechanical engineering at Washington University, Mr. Pflager worked for the Pullman Company during vacations and holidays. He was persuaded to take a permanent position with the Pullman Company in Chicago before he was graduated. Here he remained until 1901, having advanced to the position of mechanical superintendent. From 1901 to 1903 he was vice-president and general manager of the American Clock Company. In 1903 he became assistant vice-president of the American Steel Foundries.

In association with Clarence H. Howard, Mr. Pflager founded the Commonwealth Steel Company of St. Louis in 1904 and became its senior vice-president. The company pioneered in the development of large integral cast-steel structures, primarily railroad locomotives and cars. Mr. Pflager, who was in charge of engineering and operations, was largely responsible for the contribution which this company made to the railroads and heavy industry generally. He continued with the company and with its successor, General Steel Castings Corporation, as senior vice-president and board member until 1946.

Mr. Pflager has distinguished himself by the breadth of his interests and public services. He has encouraged young engineers, served educational, religious, and welfare organizations, and is a director in two St. Louis banks. In 1943 he received the George R. Henderson Medal of The Franklin Institute. He became a member of ASME in 1933 and was made a Fellow in 1944.

RECIPIENTS OF MEDALS AND AWARDS

ASME MEDAL 1950

HARVEY COLES KNOWLES, engineer, industrialist, and civic leader, whose outstanding achievements have benefited the process industries in peacetime and the continuous loading of explosive ammunition in wartime, was born in New York in 1891, and was graduated from the Sheffield Scientific School, Yale University, in 1912.

After six years as an engineer and factory superintendent with the Westinghouse Electric Corporation, Mr. Knowles became associated with the Procter and Gamble Company of Cincinnati, where he has been in charge of factory operations and the activities of the engineering division. From 1942 to 1947 he was vice-president in charge of manufacturing and since 1947 vice-president in charge of purchases. He has been a director since 1942.

Early in World War II Mr. Knowles became vice-president of Procter and Gamble Defense Corporation with the responsibility of creating and developing the Wolf Creek and Gulf Ordnance plants for shell loading. As a result of his leadership and engineering contributions, based on a scientific study of loading practice at arsenals, the plants under his charge were equipped for the conveyer-belt loading and assembly of ammunition, which reduced labor and gave, greater safety and ease of inspection, and improved quality. He served as chairman of the High-Explosive Loading Advisory Committee and the Safety and Security of the Ordnance Department and as assistant district chief of the Cincinnati Ordnance District.

Mr. Knowles is a director of Armco Steel Corporation, president and director, The Herman Schneider Foundation of Cincinnati, and vice-president and director, American Ordnance Association. He is a recipient of the AOA Rice Medal.

HOLLEY MEDAL

CHARLES GORDON CURTIS, inventor of the type of steam turbine which bears his name, was born at Boston, Mass., in 1860. He was graduated from Columbia University in 1881, and received the degrees of LLB in 1883 and MS in 1907. He practiced as a patent attorney for eight years. He gave up the practice of patent law to organize the Curtis and Crocker Electric Motor Company which produced the first electric fans, and the Curtis Electrical Manufacturing Company of which he was president.

In 1896 he patented the Curtis steam turbine which had high efficiency and a new control device. Land rights to the manufacture of this turbine were sold to the General Electric Company which is said to have spent $3,000,000 in development. He introduced the turbine into the navies of Great Britain, Japan, Germany, and the United States, and organized the International Curtis Marine Turbine Company of which he is president.

Mr. Curtis holds the first United States patent on gas turbines. He pioneered in the development of two-stroke cycle engines, and was granted numerous patents relating to exhaust turbine and supercharging. He engaged at one period of his long career on a propelling mechanism for the torpedo used by this country from 1904 until a few years ago. In 1910 he was awarded the Count Rumford gold and silver medals of the American Society of Arts and Sciences. In 1948 he was awarded a testimonial by the Gas Turbine Power Division of ASME "for his pioneer work in the field of gas turbines which resulted in his being granted, in 1899, the first American patent covering a complete gas-turbine power plant."

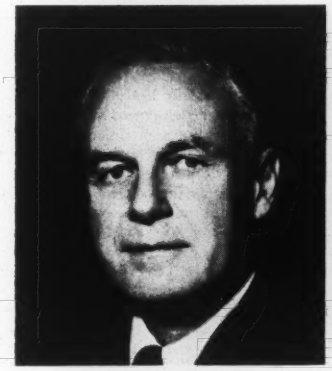
WORCESTER REED WARNER MEDAL

ORLAN WILLIAM BOSTON, for nearly 30 years a member of the faculty of the college of engineering, University of Michigan, was born at Nashville, Mich., in 1891. He was graduated from the University of Michigan in 1914 and received a master's degree in 1917, and the degree of mechanical engineering in 1926 from the same University. He was an instructor in engineering mechanics and machine design at the University of Michigan from 1914 to 1917. As an officer in the United States Naval Reserve he worked in the Bureau of Ordnance from October, 1917, to May, 1919, on the design and manufacture of submarine mines used in the North Sea barrage. The next two years were spent as industrial engineer and assistant to the vice-president and works manager of the Cleveland Tractor Company specializing in the economics of production.

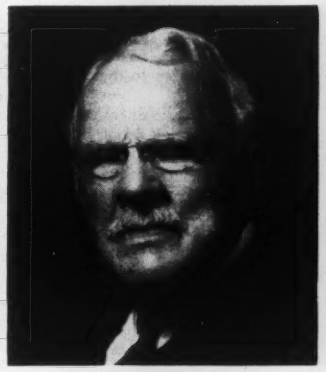
Dean Mortimer E. Cooley recalled Professor Boston to the University of Michigan in 1921, to assist in the planning of the East Engineering Building and to develop the department of metal processing which now offers a number of courses as graduate electives dealing with inspection, machinability, machine tools, and metal processing. His researches, private and sponsored, have resulted in some two hundred papers, some of which were presented before and published by ASME. He has written several books dealing with shop practice and has contributed to engineering handbooks.

Professor Boston has been active in ASME standardization work, particularly as related to small tools and machine-tool elements, and in research on the machining of metals. He is a Fellow of ASME, a member of the American Society for Engi-

Recipients of Medals and Awards



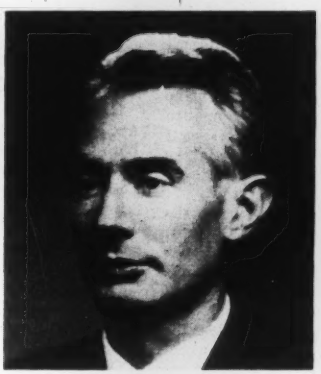
HARVEY COLES KNOWLES
ASME Medal



CHARLES GORDON CURTIS
Holley Medal

ORLAN WILLIAM BOSTON
Worcester Reed Warner Medal

HARRY IGOR ANSOFF
Spirit of St. Louis Junior Award



REINOUT PIETER KROON
Spirit of St. Louis Award

SAMUEL JASPER LORING
Melville Prize Medal

neering Education, American Society of Metals, American Society of Tool Engineers, and American Ordnance Association, and has been active on many committees of these societies.

MELVILLE PRIZE FOR ORIGINAL WORK

SAMUEL JASPER LORING, consulting engineer, Hamilton Standard Propeller Division of the United Aircraft Corporation, East Hartford, Connecticut, was the recipient of the Melville Medal for 1950 for his paper "A Theory of the Mechanical Properties of Hot Plastics," which appeared in ASME Transactions.

Born in Cincinnati, Ohio, July 23, 1914, Mr. Loring was graduated from Massachusetts Institute of Technology in 1936 with a BS degree in general engineering. From 1936 to 1945 he was employed by Chance Vought Aircraft Division of the United Aircraft Corporation in Stamford, Connecticut, first as a structural engineer, and later successively as vibration engineer, and supervisor of structural research in charge of the dynamic-analysis section.

In 1945 he established private professional-engineering practice. His chief technical work has been the development and testing of a simple device for making vibration tests on large structures. He is a specialist in mathematics; mechanics, including vibrations, dynamics, elasticity, and aerodynamics; and other branches of physics including electricity, magnetism, and thermodynamics.

He is the author of two papers published in the *SAE Journal*: "Outline of a General Approach to the Flutter Problem" in August, 1941; "Use of Generalized Co-Ordinates in Flutter Analysis," April, 1944.

He is a member of the Institute of the Aeronautical Sciences and junior member of the American Society of Civil Engineers. He became a member of The American Society of Mechanical Engineers in 1946.

PI TAU SIGMA RICHARDS MEMORIAL AWARD

BURGESS HILL JENNINGS, recipient of the Richards Memorial Award for 1950, is professor and chairman of the department of mechanical engineering at Northwestern University.

Mr. Jennings was born in Baltimore, Maryland, in 1903, and after graduation from The Johns Hopkins University in 1925, he was employed by the Consolidated Gas Electric Light and Power Company of Baltimore as cadet engineer. He left the company to attend Lehigh University where he obtained an MS degree and continued on the teaching staff for fourteen years. During the latter part of this period he was active in research and directed the mechanical-engineering laboratories. In 1940 he assumed his present duties at Northwestern University.

He is author or coauthor of five books, three of which have had extremely widespread use as college textbooks: "Air Conditioning and Refrigeration," "Internal-Combustion Engines," and "Steam and Gas Engineering." He has made particularly significant contributions to the practice and literature of refrigeration and air conditioning. During the war period he worked with the Office of Scientific Research and Development.

In the American Society of Refrigerating Engineers he has held a gamut of offices including that of president. He is a Fellow of the ASME and has been active in the Sections, student activities, and Professional Divisions. He was chairman of the Chicago Section.

He is a professional engineer, has been a consultant to many companies and government agencies, has written more than a score of research papers and articles, and holds several patents.

PI TAU SIGMA GOLD MEDAL AWARD

ARTHUR P. ADAMSON, Jun. ASME, was the 1950 winner of the Pi Tau Sigma Gold Medal Award. He was born in Chetopa, Kansas, March 14, 1919. He was graduated from the University of Southern California in 1941 with a BSME degree. While there he was elected to membership in Sigma Xi and Phi Kappa Phi, honorary fraternities.

Since joining the General Electric Company in June, 1941, he has completed the three-year advanced course and in recent years has taught portions of that course. His teaching experience also includes teaching the apparatus department servo course at the present time as well as the M.I.T. servo course for M.I.T. Co-op students, in the capacity of a nonresident M.I.T. assistant instructor. He has taught the electronic-circuits course and the engineering fundamentals course.

Mr. Adamson holds patents as follows: Angular motion-transmitting apparatus (2 patents), stator winding methods, accelerometer, self-synchronous system for transmitting angular motion, and winding of electric machines.

He is a member of a working group on guided-missiles test equipment as a part of a government committee of the Research and Development Board. He was awarded the General Electric Company Coffin Award jointly with another employee, Mr. Dave Lawton, covering their work on stator windings.

Mr. Adamson is in charge of a group in the navigation control section, Systems Development Division, Aeronautic and Ordnance Systems Divisions of the General Electric Company, concerned with the development of steering systems for guided missiles.

SPIRIT OF ST. LOUIS MEDAL

REINOUT P. KROON, Mem. ASME, was the 1950 recipient of the Spirit of St. Louis Medal for his leadership in the development of the first American design of a turbojet power plant for aviation service, making possible increased plane speeds, higher altitude limits, and more efficient airplane design; and for his technical leadership in the many fields which have contributed to the advance of American aviation.

Since its inception at Westinghouse in 1941, the technical direction of aviation turbojet-engine development has been Mr. Kroon's responsibility. Basic in the design objectives were high power in small diameter which was accomplished by using an axial flow compressor with an integral annular combuster, each developed for the first time for aviation use.

In resulting constructions, by comparison with piston engines, horsepower was tripled—from 4000 to 12,000—with a power plant of fifth weight and 40 per cent as great frontal area, and plane speeds were increased from 400 to 600 mph and altitude limits from 40,000 to 60,000 ft.

Mr. Kroon was born in Holland in 1907, graduated from the Zurich Graduate Technische Hochschule in 1921, came to the United States in 1931, and became a citizen in 1938.

In ASME he was chairman of the Aviation Division in 1947 and of the Applied Mechanics Division in 1950. He is serving on the Technical Board of the SAE, The Power Plant Committee of the NACA, and the Engine Technical Committee and Army-Navy-Industry Committee of Aircraft Industries Association.

The Spirit of St. Louis Medal was presented to Mr. Kroon at the 1950 Semi-Annual Meeting, St. Louis, Missouri.

SPIRIT OF ST. LOUIS JUNIOR AWARD

HARRY I. ANSOFF was awarded the Spirit of St. Louis Junior Award for his paper "Stability of Linear Oscillating Systems With Constant Time Lag."

Mr. Ansoff was born of American parents in Vladivostok, Russia, on December 12, 1918. He attended Stuyvesant High School in New York, N. Y., and received the ME and MS degrees from Stevens Institute of Technology. At Stevens he was president of the local chapter of Tau Beta Pi and valedictorian of the class of 1941. In 1941 he was appointed instructor and later faculty instructor in physics at Stevens where he taught until 1944.

In August, 1944, he was commissioned in the U. S. Naval Reserve. While on active duty, he did liaison work with naval officers of the USSR and later taught physics at the U. S. Naval Academy. He received a PhD degree in Applied Mathematics in 1948 from Brown University, where he was awarded a Junior Fellowship in Applied Mathematics and was elected an associate member of Sigma Xi.

He is now employed as an associate mathematician by the Rand Corporation in Santa Monica, California.

The Spirit of St. Louis Junior Award was presented to Mr. Ansoff at the 1950 Semi-Annual Meeting, St. Louis, Missouri.

CHARLES T. MAIN AWARD

RICHARD T. JOHNSON was awarded the Charles T. Main Award for his paper "The Need for Conversion to a Five-Year Course in Engineering Instruction for the Bachelors Degree in Order to Include Additional Instruction in the Humanities, and in Public Relations."

Mr. Johnson was born in Detroit, Michigan, October 1, 1920, and attended the local grade and high schools. In 1938 he was enrolled at the University of Detroit. From 1943 to 1947 he served as a pilot in the U. S. Marine Corps. He returned to the University of Detroit in 1947 and completed his courses in 1950.

Recipients of Medals and Awards

ARTHUR PAUL ADAMSON
Pi Tau Sigma Gold Medal Award

BURGESS HILL JENNINGS
Pi Tau Sigma Richards Memorial Award

RICHARD THOMAS JOHNSON
Charles T. Main Award

JAMES NORRIS COLEBROOK
Undergraduate Student Award

He is employed as a sales engineer by the Byron Jackson Company in Los Angeles, California.

UNDERGRADUATE STUDENT AWARD

JAMES N. COLEBROOK, Jun. ASME, was the recipient of the Undergraduate Student Award for 1950 for his paper "Design and Construction of a Pressure Transducer Testing Machine."

Mr. Colebrook was born in Chicago, Illinois, March 28, 1922. He was graduated in June, 1939, from the Withrow High School in Cincinnati, Ohio, and from 1943 to 1945 he served in the U. S. Army Air Corps as a fighter pilot.

He studied in the college of engineering at the University of Cincinnati after his military service. He was graduated in June, 1950, with the ME degree. While at the university he was a student member of ASME and was elected to Pi Tau Sigma.

At this time he is employed as a design engineer by the J. H. Day Company in Cincinnati, Ohio.

ASME 1950 ANNUAL MEETING PREPRINTS

Pamphlet copies of the following ASME Annual Meeting Papers are available from ASME Order Department, 29 West 39th St., New York 18, N. Y.
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50—A-4	The Limit Design of Space Frames, by JACQUES HEYMAN
50—A-6	Axially Symmetrical Plates With Linearly Varying Thickness, by H. D. CONWAY
50—A-7	Analysis of Deep Beams, by H. D. CONWAY, L. CHOW, and G. W. MORGAN
50—A-8	On the Extrusion of a Very Viscous Liquid, by HERSCHEL WEIL
50—A-9	Free Vibrations of a Pin-Ended Column With Constant Distance Between Pin Ends, by DAVID BURGREEN
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REVIEWS OF BOOKS

And Notes on Books Received in the Engineering Societies Library

Production of Screws

SCHRAUBENHERSTELLUNG. By Ernst Lickteig. Verlag Stahleisen, MBH, Dusseldorf, Germany, 1950. Second edition. Cloth 6¼ × 9 in., 176 figs., 11 tables, Bibliography, name and subject indexes, xiii and 244 pp., 26 dm.

REVIEWED BY W. TRINKS[1]

THIS book deals with the production of bolts and nuts. The production of wood screws and of screws for transmitting motion is not discussed.

Twenty-six pages are devoted to the history of making bolts and nuts. Stresses in bolts and nuts are discussed in 40 pages. Testing of raw material and of finished bolts takes up eighteen pages.

The important fourth chapter (state of the manufacture of bolts and nuts) fills 70 pages. It is subdivided into production and composition of steel, warm-heading and cold-heading, minor processes, threading by chip-removal and by plastic deformation, heat treating, and finally production of nuts. Then follow 13 pages on the production of corrosion-resisting bolts, of heat-resisting bolts, and of bolts for aircraft. Chapter 6 (14 pages) is partly a repetition of chapter 4, but more attention is devoted to apparatus and machinery. Chapter 7 brings 33 pages of standards for materials and finished bolts. The largest part of this chapter is devoted to German standards; however, U. S. and British standards are discussed briefly. Then follow 13 pages on patents concerning bolts and boltmaking, and finally an extensive bibliography.

Lickteig's book is a creditable piece of work. His theory on stresses in bolts and nuts is incomplete and not entirely correct. In the manufacture of bolts no mention is made of the comparometer. There are other but minor omissions. However, by and large, the book contains a large amount of useful information. Lickteig acknowledges that in the mass-production of bolts and nuts the United States is ahead of other countries.

The men at the top of our screw-and-bolt factories will have little use for Lickteig's book, but the younger men who are now climbing up the ladder of success will be greatly benefited by studying it.

[1] Professor Emeritus, Carnegie Institute of Technology, Pittsburgh, Pa. Fellow ASME.

Physiology of Heat Regulation

PHYSIOLOGY OF HEAT REGULATION and The Science of Clothing. Prepared at the Request of the Division of Medical Sciences, National Research Council. Edited by L. H. Newburgh. W. B. Saunders Co., Philadelphia, Pa., London, England, 1949. Cloth, 5¾ × 9¼ in., 78 figs., tables, references, appendix, index, viii and 457 pp., $7.50.

REVIEWED BY R. B. FINCH[2]

MAN'S ability to predict the weather and inability to control it is a matter of universal interest and daily personal concern. Man has been able to do something about his local climate by adapting himself to the weather through his choice of appropriate clothing. Down through history, his essentially practical nature in the selection of those components which would give him the greatest comfort has gradually become dominated by his style-consciousness. This has resulted in clothing today which is fashionable but often admittedly uncomfortable.

The military services have of necessity become greatly concerned with how man can best be protected from the environmental extremes to which he is subjected. Military requirements are purely functional and style compromises do not have to be made. The lack of scientific knowledge in this area made it necessary for the military services to initiate an extensive program for the purpose of studying how man generates heat, what physiological changes take place during various types of activity and inactivity, and how clothing may be utilized to make him comfortable under these conditions.

This book is a collection of well-edited studies sponsored by the military services during and since World War II. The approach to the subject is a fundamental one. It represents the first truly consolidated study of this subject and is complete in its literature coverage as well as in its report of original work specifically devoted to the basic problem of the military services. The introductory section is a most interesting study of the shelter and clothing customs of various groups living under extreme environmental conditions. Cultures described range from those subjected to cold (such as the Eskimo, the tribes of Northeastern Siberia, the Northern Chinese, the Mongols, the Fuegians and the Australian Aborigines) to those subjected to heat (such as the peoples of the Near East, the Sahara, Southeastern Asia, and Central America). It is pointed out that their ability to adapt themselves to their environment is worthy of considerable study for clues as to the universal principles governing man's adaptation to a wide range of environmental stresses.

ROLE OF CLOTHING

The sections on thermometry, heat transfer, regulation of body temperatures, physiological adjustments to heat and cold, regional heat loss, range of physiological response to climatic heat and cold, and indices of comfort, provide a sound basis for the study of the quantitative role that clothing must play in regulating heat in the human being.

These sections are outstanding in themselves as contributions to the principles underlying the design of functional clothing.

The section on the study of clothing as a thermal barrier contains detailed information on fabric and clothing assembly properties. This is supplemented by an analysis of laboratory and field studies of clothing assemblies on actual subjects and is concluded with an analysis of the performance of these assemblies under the wide range of climatic conditions to which many may be expected to be exposed.

The primary emphasis in the entire book is upon the maximal capacity of the human body to preserve itself under the most adverse conditions and the

[2] Professor of Textile Technology, Massachusetts Institute of Technology, Cambridge 39, Mass. Mem. ASME.

degree to which it is possible to cope with unfavorable environments through the use of scientifically designed protective clothing assemblies. The contributors are frank to admit that they are not providing final answers but rather that there are many defined areas in which further investigations must be and are continuing.

A CO-OPERATIVE STUDY

It is perhaps most significant that it has required the co-ordinating abilities of a group with the scientific stature and breadth of the Division of Medical Sciences of the National Research Council to make such a study possible. The list of contributors is sufficient to indicate that the attack of such a basic problem requires co-ordination of the top talent of a wide variety of fields. The book, edited by Dr. L. H. Newburgh, professor of clinical investigation, the Medical School, University of Michigan, was contributed to by a group of distinguished physiologists, hygienists, military geographers, textile technologists, physicists, sociologists, and anthropologists.

MUCH TO LEARN

The textile industry has much to learn from this publication. For the first time a truly quantitative basis is provided upon which it can build sound principles of clothing design. Unfortunately, although not in criticism of the book, the science of clothing has progressed little beyond what is reported here. An engineering basis for clothing-assembly design is now possible but is not provided by this book. The clothing designer cannot immediately use this book for the purpose of designing better clothing assemblies. It is the textile materials engineer who must interpret these findings in terms which the designer can understand before we as individuals may hope to benefit in the form of more comfortable clothing.

This report provides a basis for the refutation or substantiation of many hitherto indisputable claims regarding the superiority of certain fabric designs, fiber contents, and fabric finishes when used in clothing or blankets. The benefits of such studies will not, however, be realized for some time as the general public is almost completely influenced by style changes as dictated by a Parisian designer, a royal dinner jacket, or a highly advertised and promoted pseudo-scientific novelty. Despite this, we can reasonably expect to benefit ultimately from this consolidated study through an improvement in clothing comfort within the realm of style and fashion.

The Human Use of Human Beings

THE HUMAN USE OF HUMAN BEINGS: Cybernetics and Society. By Norbert Wiener. Houghton Mifflin Company, Boston, Mass., 1950. Cloth, 5¼ × 8 in., index, 241 pp., $3.

REVIEWED BY J. M. JURAN[3]

SEVERAL years ago Dr. Wiener, a professor of mathematics at M.I.T., created a mild stir by coining a new word "Cybernetics" as the title of a book dealing with the general problem of "communication and control in the man and the machine." The existence of this general problem has long been known to biologists and to students of management. Dr. Wiener served a useful purpose by dramatizing the subject and by presenting a most constructive discussion of it.

"Cybernetics" was directed at a scientific audience. The book under review purports to be a related book "for the layman." However, the present book fails to achieve this purpose. Only occasionally is it for the layman. Only occasionally is it even on the subject. Instead the present book is a wandering series of observations on numerous topics, the common connecting link being the vehemence with which the author's prejudices are expounded. But those patient souls who undertake to follow the author through the entire book will find much that is profound, as well as much that is debatable, and much that is naive.

The layman who would understand cybernetics would do well to wait for an author and a publisher who can develop, and then follow, an outline of the subject.

[3] Chairman, Department of Industrial Engineering, New York University, New York, N. Y. Mem. ASME.

Books Received in Library

ASTM STANDARDS ON PLASTICS, sponsored by ASTM Committee D-20 on Plastics; Specifications, Methods of Testing, Nomenclature, Definitions. June, 1950. American Society for Testing Materials, Philadelphia, Pa. Paper, 6 × 9 in., 1076 pp., illus., charts, tables, $4.85. Some 120 specifications and test methods are presented, covering a wide range of subject matter. The separate standards are classified broadly under the following headings: specifications for plastics; strength, hardness, thermal, optical, and permanence properties; analytical methods for plastics; molds and molding processes; conditioning; electrical tests; sheets, tubes, rods, and molded insulating materials; definitions.

ATOMIC PHYSICS. By W. Finkelnburg. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth, 6¼ × 9¼ in., 498 pp., illus., diagrams, charts, tables, $6.50. A translation and minor revision of the author's German text, this book provides a systematic treatment of the whole field of nuclear, atomic, molecular, and solid-state physics. It starts at a comparatively low level and provides a basis for an understanding of important theories, empirical facts, unsolved problems, and present trends of research in the field.

AUTOMATIC TRANSMISSIONS, Simplified. By J. Purvis. Goodheart-Willcox Company, Chicago, Ill., 1950. Cloth, 6 × 8¾ in., 264 pp., illus., diagrams, charts, tables, $4. Covering all types of automobile transmissions, this practical book starts with a brief section on sliding-gear and planetary-gear manually operated transmissions, overdrive mechanisms, and so on. The following two sections deal in essential detail with the automatically operated transmissions and torque-converter units. Detailed drawings and schematic diagrams assist in interpreting the text.

BIBLIOGRAPHY OF CENTRIFUGAL CASTING. Prepared by H. F. Taylor and C. L. Register, published by American Foundrymen's Society, Chicago, Ill., 1949. Paper, 6 × 9 in., 108 pp., $2.25. Covering the literature in the field through 1948, this publication contains, in addition to a bibliography of periodical literature and United States patents, a brief history of the development of centrifugal casting and a discussion of fundamental principles. For each reference there is an indication of the nature of the information, the kind of metal discussed, the axis of rotation considered, and the kind of mold used.

BRITISH DIESEL ENGINE CATALOGUE. Second edition. Published for the British Internal Combustion Engine Manufacturers' Association, London, England, by Temple Press Ltd., 1950. Cloth, 10¼ × 15¼ in., 277 pp., illus., diagrams, charts, tables, 52s 6d. This book provides information on Diesel engines of thirty-three makes from the United Kingdom. The engines are separately indexed for: industrial duties, railway-traction purposes, marine propulsion, and marine auxiliary services. The tables of specifications are similar in layout and content to allow for quick and accurate comparisons. All vital statistics on any engine are in these tables.

CASTING AND FORMING PROCESSES IN MANUFACTURING. By J. S. Campbell, Jr. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth, 6¼ × 9¼ in., 536 pp., illus., diagrams, charts, tables, $5. Written principally for mechanical-engineering students, this text devotes more than half the book to casting processes. Plastics-molding and forming, powder metallurgy, rolling, forging, sheet-metal working, and punch-press operations

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are dealt with in the remaining chapters. Machine-shop and welding processes are not included. Special emphasis is placed on both the design and the modern mass-production viewpoints. Mechanization in the foundry is considered in detail.

CENTRIFUGAL CASTING BY THE CIRE PERDUE PROCESS. By C. Rosen, foreword by G. E. Gardam. Contact Publishers Ltd., London; sole distributors in United Kingdom, Bruce Publishing Co., Ltd., Bruce Grove, Watford, Herts., England, 1949. Linen, 6 × 9¼ in., 204 pp., illus., diagrams, charts, tables, 52s, 6d. This book collates the available information concerning the centrifugal adaptation of the lost-wax method of precision investment casting. Written from the practical point of view, it surveys such topics as the production of a master pattern and mold, the casting, mounting, and investing of wax patterns, vacuum treatment of investment, drying and preheating, metal casting, and cleaning and finishing. An easy guide is included which summarizes the process and the equipment needed.

CONTRIBUTION À LA THEORIE GENERALE DES ABAQUES À PLANS SUPERPOSES. By G. R. Boulanger, preface by M. Frechet. Gauthier-Villars, Paris, France, and Robert Louis, Brussels, Belgium, 1949. Paper, 7¾ × 11 in., 117 pp., diagrams, charts, 1200 fr. Based upon the theory of the two-dimensional abacus, this publication considers the situation where an indefinite number of planes are superimposed. The author also goes into the development of the concept of polydimensional nomograms, including the general theory of nomograms in any indefinite number of planes.

DAVISON'S TEXTILE BLUE BOOK, 85th Year, July, 1950, handy edition. Davison Publishing Company, Ridgeood, N. J. Fabrikoid, 5 × 8 in., 1415 pp., illus., maps, tables, handy edition (without classified directory and buyer's guide) $5.75. Office edition (with classified directory and buyer's guide), $8.25. This standard directory contains condensed information concerning mills of the textile industry, covering cotton, woolen, rayon, silk and jute goods, and those using the processes of knitting, dyeing, sanforization, and so on. Related activities covered include listings of brokers, exporters, foreign firms, trade associations, testing laboratories, textile schools, and railroads serving the trade.

DIESEL ENGINE CATALOG, vol. 15, 1950. Published and distributed by Diesel Engines, Inc., Los Angeles, Calif. Fabrikoid, 10½ × 13¾ in., 368 pp., illus., diagrams, charts, tables, $10. This fifteenth volume of the Diesel Engine Catalog provides a cross section view of the Diesel industry in the United States, covering also several British manufacturers and one Danish firm. It lists in detail the engines now available from over fifty manufacturers, as well as auxiliary equipment and transmission products. New designs developed during the past year are included. In addition there is a classified listing of the names and addresses of Diesel engine and accessory manufacturers.

ELECTRIC WINDERS. By H. H. Broughton. Second edition. E. & F. N. Spon Ltd., London, England, 1948. Fabrikoid, 7½ × 9¾ in., 451 pp., diagrams, charts, tables, 63s. Intended primarily for the engineering staffs of coal and metalliferous mines, this volume is also of interest to those who design, construct, and operate mine-hoisting equipment. In this edition, the first since 1927, nearly the whole text is rewritten, and seven new chapters are added. The new material is on Koepe-pulley winders, deep-level winding, intensive hoisting, skip-hoisting of coal, and so on. Of special note is the large number of tables and detail diagrams, detailed accounts of failures, and the chapter bibliographies.

ENGINEERING ECONOMY. By H. G. Thuesen. Prentice-Hall, New York, N. Y., 1950. Cloth, 5¾ × 8½ in., 501 pp., diagrams, charts, tables, $6.65. The importance of considering thoroughly the economic as well as the technical aspects in the solution of engineering problems is stressed throughout the book. To this end the several chapters deal with the basic mathematical factors, the treatment of estimates, various kinds of costs and accounting methods, bases for comparison of alternatives, evaluation of replacements, economy of operations, utilization of personnel, and the application of engineering economy studies to public activities. Illustrative numerical examples are used.

FOREST PRODUCTS. By N. C. Brown. John Wiley & Sons, Inc., New York, N. Y.; Chapman & Hall, Ltd., London, England, 1950. Cloth, 5½ × 8¾ in., 399 pp., illus., diagrams, charts, tables, maps, $5. Based on the author's "Timber Products and Industries," this book is concerned with the harvesting, processing, and marketing of forest products other than lumber. Constructional materials, chemically derived products, wood containers, mechanically reduced products, and wood as a fuel are among the topics covered. For each product treated the fundamental principles, technical processes and developments, and economic problems are considered. A glossary of terms and a selected bibliography are included.

FOREST PRODUCTS, Their Sources, Production, and Utilization. By A. J. Panshin, E. S. Harrar, W. J. Baker, and P. B. Proctor. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth, 6 × 9¼ in., 549 pp., illus., diagrams, charts, maps, tables, $6. This text considers the origin, methods of conversion, and utilization of primary and secondary forest products. Of the four main sections, the economics of forest utilization are considered first. Various types of wood products are then discussed in the most extensive section, followed by two shorter sections on chemically derived and secondary forest products. A list of selected references follows each chapter.

FRICTION AND LUBRICATION OF SOLIDS. By F. P. Bowden and D. Tabor. Oxford University Press, New York, N. Y.; Clarendon Press, Oxford, England, 1950. Cloth, 6¼ × 9½ in., 337 pp., illus., diagrams, charts, tables, $7. This monograph describes an experimental study of the physical and, to a less extent, of the chemical processes that occur during the sliding of solids, with special attention given to metals. It also contains the results of an investigation into the mechanism of friction and of boundary lubrication. As it deals almost entirely with experimental research, it is not a general textbook, but does cover a number of the physical properties of solid surfaces. The treatment of the subject matter is highly detailed, and references are given to pertinent literature.

GAS PRODUCERS AND BLAST FURNACES, Theory and Methods of Calculation. By W. Gumz. John Wiley & Sons, Inc., New York, N. Y.; Chapman & Hall, Ltd., London, England, 1950. Cloth, 5¾ × 8¾ in., 316 pp., diagrams, charts, tables, $7. Theory and calculation methods for gasification processes are developed in detail. In part 1, gasification reactions, gas composition at equilibrium and at incomplete equilibrium, and gas-producer performance are treated mathematically. Part 2 deals with blast-furnace gas and computations. Reactive kinetics are considered in part 3. The appendix contains valuable tabulated data.

HEAT ENGINES. By A. C. Walshaw. Third edition. Longmans, Green and Co., London, England; New York, N. Y.; Toronto, Canada, 1949. Linen, 5 × 7½ in., 473 pp., illus., diagrams, charts, tables, $2.25. This book explains the fundamental principles underlying the subject, illustrates them by means of diagrams and sketches, applies them to engineering problems, and describes the principles used in the testing of engines. It is divided into three parts: introductory work on heat and heat engines; steam and steam-engine plant; and compressors and internal-combustion engines.

INDUSTRIAL ACCIDENT PREVENTION. By H. W. Heinrich. Third edition. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth, 6¼ × 9¼ in., 470 pp., illus., diagrams, charts, tables, $5. Placing special emphasis on the human factor in safety work, this book provides full coverage from fundamentals through specific methods and devices to the setting up and carrying out of full-scale safety programs. New chapters on motor-vehicle fleets, supervision, personal protective devices, and a short-form safety course are included in this edition. New material is also added to the sections on accident hazards and production faults, supervisory control of employee performance, and cause analysis of boiler and machinery accidents.

INTERNAL COMBUSTION ENGINES, Analysis and Practice. By E. F. Obert. Second edition. International Textbook Co., Scranton, Pa., 1950. Linen, 6 × 9¼ in., 596 pp., illus., diagrams, charts, tables, $7.25. This book contains essential information on present-day engines that will interest the beginner as well as the engine specialists. In this second edition, the fundamentals of the reciprocating-piston engine and the gas turbine are developed together and critically compared. New material and problems have been added on detonation, lubrication, engine indicators, Diesel and dual-fuel engines, compressors, gasoline and fuel-oil injection systems, and jet propulsion.

METALS AND ALLOYS. By the Technical Staff of *Metal Industry*. Chemical Publishing Co., Brooklyn, N. Y., 1950. Cloth, 5½ × 8¾ in., 214 pp., tables, $5. For the use of metallurgists, engineers, and others who use and buy metals, this reference book lists in tabular form the composition of some 4600 alloys, largely nonferrous. In the cases where no definite trade name exists the alloy is placed under a composition-type heading, and a general description of its purpose is cited. ASTM and British Standard Specification designations are included.

PLANT ENGINEERING HANDBOOK. Edited by W. Staniar. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth 6×9¼ in., 2007 pp., diagrams, charts, tables, $15. Prepared by a staff of specialists, this comprehensive new reference work covers the essentials of good practice in the economic, mechanical, chemical, and power areas of modern industrial-plant operation. Topics covered include the following: industrial costs and management; plant construction and maintenance; fire prevention; water treatment; power plants and refrigera-

tion; instrumentation and control; mechanical and hydraulic power systems; bearings and lubrication; materials handling and conveying; and a wide range of basic processes, materials, problems, and miscellaneous information. A detailed 50-page index is provided.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. Ninth edition. Lincoln Electric Company, Cleveland, Ohio, 1950. Fabrikoid, $5^3/_4 \times 8^3/_4$ in., 1200 pp., illus., diagrams, charts, tables, $2 in U. S. A.; $2.50 foreign. In the ninth edition of this handbook, the data have been reorganized and consolidated to retain all currently useful material from the previous edition and to include new material. The main section headings are: arc-welding history, processes, equipment, and nomenclature; weldability of metals; techniques, procedures, speeds, and costs for welding mild steel; basic design data for welded construction; machinery design with arc-welded construction; designing of arc-welded structures; inspection and testing of weld metal and welding operators; and miscellaneous applications of arc welding in manufacture, construction, maintenance.

PROCESS HEAT TRANSFER. By D. Q. Kern. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth, $6 \times 9^1/_4$ in., 871 pp., illus., diagrams, charts, maps, tables, $8. Combining both theory and modern practice, this text provides systematic instruction in the calculations, derivation, and empirics of heat transfer, using the language and methods of industry. Each principle is developed within the actual equipment and flow patterns in which it occurs in the majority of industrial operations. All calculations are treated as interrelated occurrences between hot and cold agents through a single surface. Worked and unworked problems are included.

REFRESHER NOTES FOR PROFESSIONAL ENGINEERS LICENSE EXAMINATION. By J. D. Constance. Third edition. John D. Constance, 625 Hudson Terrace, Cliffside Park, N. J., 1950, paged in sections. Stiff paper, $8^1/_2 \times 11$ in., diagrams, charts, tables, photo-offset, $4.50. Of interest to those preparing for Professional Engineers License Examinations, this volume contains condensed basic-information problems and their solutions from the fields of hydraulics, thermodynamics, and machine design. Thirty pages of problems are added, and a new chart on four-bar linkages.

RESPONSE OF PHYSICAL SYSTEMS. By J. D. Trimmer. John Wiley & Sons, Inc., New York, N. Y.; Chapman & Hall, Ltd., London, England, 1950. Cloth, $5^1/_2 \times 8^3/_4$ in., 268 pp., diagrams, charts, tables, $5. This book on instrumentation and the measurement process demonstrates the application of mathematical techniques to physical systems. Closely linked with cybernetics, it includes not only such physical systems as instruments, regulators, and servos, but also some reference to biological and sociological entities as well. The intent is to provide a broad general study of system response to input forces, covering feedback, and other control methods. A full working knowledge of calculus is essential and a study of differential equations recommended.

STATISTICAL DECISION FUNCTIONS. (Wiley Publications in Statistics.) By A. Wald. John Wiley & Sons, Inc., New York, N. Y.; Chapman & Hall, London, England, 1950. Cloth, $6 \times 9^1/_4$ in., 179 pp., tables, $5. Treating the subject from a rigidly mathematical point of view, this book presents a recently developed general theory which is used to decide which one of several alternative decisions is best, e.g., which one of several industrial processes entails the minimum risk. The theory of multistage experimentation and the general multidecision problem are also included. Some knowledge of probability, including probability distributions in the infinite dimensional space, is assumed.

STEEL CASTINGS HANDBOOK, 1950 edition. Edited by C. W. Briggs, published by Steel Founders' Society of America, Cleveland, Ohio. Fabrikoid, $6 \times 9^1/_4$ in., 511 pp., illus., diagrams, charts, tables, $4. Intended as a reference book for those interested in using steel castings in mechanical structures and assemblies, this manual contains detailed data on the design, manufacture, heat-treatment, mechanical and engineering properties, and applications of various kinds of steel castings. Pertinent steel-casting specifications, a glossary of foundry terms, and the chemical composition of standard cast steels are included. The extensive use of graphs and tables increases the practical value of the book.

SYMPOSIUM ON APPLICATION OF STATISTICS, presented at the First Pacific Area National Meeting, American Society for Testing Materials, San Francisco, Calif., October 11, 1949. (Special Technical Publication No. 103.) American Society for Testing Materials, Philadelphia, Pa. Paper, 6×9 in., 36 pp., charts, tables, $1 (to ASTM members, $.75). This pamphlet contains the three technical papers, with discussion, which were presented at a symposium sponsored by the Committee on Quality Control of Materials. The papers deal with the economic relationship between design and acceptance specifications, the precision and accuracy of test methods, and the use of statistics to determine precision test methods.

SYMPOSIUM ON DYNAMIC STRESS DETERMINATIONS. (Special Technical Publication No. 104.) American Society for Testing Materials, Philadelphia, Pa., 1950. Paper, 6×9 in., 61 pp., illus., diagrams, charts, tables, $1.50 (to A.S.T.M. members, $1.15). This symposium deals with the scope, applicability, possibilities, and limitations of electronic measuring and recording devices as used in investigating the dynamic conditions of materials and structures. The four papers cover respectively an analysis and interpretation of dynamic records, a survey of pickups for dynamic physical measurements, the selection of recording equipment for dynamic testing, and some practical examples of dynamic testing.

SYMPOSIUM ON EVALUATION TESTS FOR STAINLESS STEELS, presented at the Fifty-Second Annual Meeting at Atlantic City, June 30, 1949. (Special Technical Publication No. 93.) American Society for Testing Materials, Philadelphia, Pa., 1950. Paper, 6×9 in., 231 pp., illus., diagrams, charts, tables, $2.50. This symposium presents a critical appraisal of some of the testing methods that are in regular use for evaluating certain corrosion-resistant characteristics of chromium-nickel and related steel alloys. Special attention is focused on (1) the significance of results of the laboratory evaluation tests with relation to practical experience under diverse service conditions, and (2) the effects on behavior of the alloys in test and in use of lowering the carbon content to extreme low limits.

SYMPOSIUM ON HIGH ADDITIVE CONTENT OILS. (Special Technical Publication No. 102.) American Society for Testing Materials, Philadelphia, Pa., 1950. Paper, 6×9 in., 63 pp., illus., charts, tables, $1.75. Of interest to equipment and lubricant manufacturers, this symposium considers a new type of heavy-duty lubricating oil developed to meet severe conditions in engines using high-sulphur fuels. The four papers discuss the use of high-quality lubricating oils, high-detergency motor oils, experience with special heavy-duty oils, and possible future military engine oils for ground equipment.

TABLE OF THE BESSEL FUNCTIONS $Y_0(z)$ AND $Y_1(z)$ FOR COMPLEX ARGUMENTS, prepared by the Computation Laboratory, National Bureau of Standards. Columbia University Press, New York, N. Y., 1950. Cloth, $8 \times 10^3/_4$ in., 427 pp., diagrams, tables, $7.50. A companion volume to a preceding publication of tables of Bessel functions of the first kind, the present volume tabulates $Y_0(z)$ and $Y_1(z)$ for complex arguments defined in polar coordinates. Along each of the rays $\varphi = 0°$, $5°$, . . . $90°$, ten-place values of the real and imaginary parts of the functions are given for values of $|z|$ ranging from 0 to 10 at intervals of .01. The tables are designed to aid in the solution of boundary-value problems for annular regions with homogeneous linear-boundary conditions.

THEORY AND PRACTICE OF INDUSTRIAL RESEARCH. By D. B. Hertz. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Linen, $6^1/_4 \times 9^1/_4$ in., 385 pp., diagrams, charts, tables, $5.50. This book deals with the process of research as it applies to industry and covers the fundamental requirements of research operations. It isolates the elements of the research process analytically and then synthetically constructs an industrial research methodology. The first four chapters present theoretical background and analytical material on creative mentalities, problem solving, and scientific method. The remaining chapters apply these concepts to industrial research. A bibliography of references is included.

THEORY OF FLOW AND FRACTURE OF SOLIDS, vol. 1. By A. Nadai. Second edition. McGraw-Hill Book Co., Inc., New York, N. Y.; Toronto, Canada; London, England, 1950. Cloth, $6 \times 9^1/_4$ in., 572 pp., illus., diagrams, charts, tables, $10. Emphasizing mathematical principles and mechanical laws governing flow and fracture, this book is the first of a two-volume revision of the author's earlier work, "Plasticity." The scope of this edition is broadened by a survey of the general conditions causing fracture in materials and by a discussion of some of the details and results of research on the yielding and fracture of ductile metals under combined stress. The second volume is to deal with applications of the principles set forth in vol. 1.

UNIT OPERATIONS. By G. G. Brown and Associates. John Wiley & Sons, Inc., New York, N. Y.; Chapman & Hall, Ltd., London, England, 1950. Cloth, $8^1/_2 \times 11^1/_4$ in., 611 pp., illus., diagrams, charts, tables, $7.50. Stressing the similarity of basic principles as applied in various industries, this treatise by twelve authorities in the field presents a comprehensive treatment of modern process operations. The unit operations are classified according to their function and the phase or phases treated, i.e., part 1 is devoted to operations involving solids; part 2 to fluids; part 3 to the transfer of material from one phase to another separation by mass transfer; and part 4 to heat transfer, evaporation, and other similar operations, including a thorough coverage of the topics of energy and mass transfer rates.

THE ENGINEERING PROFESSION

News and Notes

As Compiled and Edited by A. F. Bochenek

James M. Todd Elected President of EJC

JAMES M. TODD, past-president ASME, was elected president of the Engineers Joint Council at a meeting of the Council held at the Engineering Societies Building on Nov. 17, 1950. Mr. Todd assumes his office on Jan. 1, 1951, for a term of one year. Other officers elected are: James F. Fairman, past-president AIEE, vice-president; C. E. Davies, secretary ASME, secretary; and E. L. Chandler, assistant secretary ASCE, treasurer. Chairmen of EJC committees for 1951 will be announced later. L. E. Young, past-president AIME, presided at the meeting.

Science Legislation Panel

B. A. Bakhmeteff, chairman of the EJC Science Legislation Panel which represented the EJC point of view in events leading up to the establishment of the National Science Foundation, reported that three of the EJC nominees had been appointed by the President to the National Science Foundation Board: E. L. Moreland, D. H. McLaughlin, and A. A. Potter. (For complete list of members of the board see page 1021 of the December issue.) He strongly urged EJC to continue to show interest in the National Science Foundation and the work of the Board, and on motion, the Panel, under Dr. Bakhmeteff's leadership, was asked to continue its work and to explore the situation. The Panel was asked to prepare a comprehensive statement of the agencies concerned in research and development at the national level for the information of EJC, and a letter of appreciation to President Truman was authorized. It was suggested that a new name be found for the Panel and a report was requested for the next meeting.

Committee of Secretaries

For the Committee of Secretaries Mr. Robie reported several meetings, mostly devoted to the man-power situation, and stated that a mailing piece, urging co-ordination of convention dates of all engineering societies, was to be sent out.

International Relations

For the Committee on International Relations, Mr. Gates reported, among other matters, the plans for the establishment of a Union of International Engineering Organizations that were laid at a meeting in Paris, Oct. 9-13, 1950, of representatives of 15 international engineering groups, under the sponsorship of UNESCO.

Mr. Gates read the main objectives of the proposed union, as follows:

(1) To co-ordinate. . . the activities of the member organizations and in particular the programs and dates of international congresses.

(2) To take all useful steps for the moral and material support of the member organizations.

(3) To receive proposals and to make recommendations thereon with a view to helping the formation of new international organizations in fields not covered by existing organizations.

(4) To further mutually helpful relations among the member organizations and similar organizations and also relations between the member organizations, the UN, and their specialized agencies.

Mr. Gates also read the list of organizations which took part in the Paris talks, and the officers and members of the Executive Council of the Union, whose legal domicile was determined to be Paris.

Selected Engineering Personnel

Mr. Davies reported that the complete report of the ONR Survey of Selected Engineering Personnel had been issued in two parts.

Increased Unity

For the Committee on Unity within the engineering profession, H. S. Osborne reported a meeting held on Sept. 21, 1950, of representatives of EJC and ECPD. S. D. Kirkpatrick, as chairman of the ECPD Committee, was invited to attend future meetings of EJC. He had reported the results of the Joint Meeting to ECPD at its Annual Meeting in Cleveland in October.

Man Power

E. G. Bailey reported that an organization meeting of the EJC Engineering Man-Power Commission, established on Sept. 15, 1950, at the request of the National Security Resources Board, had been held on Oct. 12, 1950. A working committee had been organized and consisted of the following: C. E. Davies (ASME), chairman, Carl E. Beam (ASCE), George B. Corless (AIME), A. C. Monteith (AIEE, with H. N. Muller, alternate), S. L. Tyler (AIChE), S. C. Hollister (ASEE), and Donald B. Prentice, secretary. The working committee had met three times and, in addition, once in Washington with representatives of the American Chemical Society, American Institute of Physics, and the National Research Council, each of which had been asked by NSRB to frame a program for the better utilization of personnel in event of emergency. A reply to NSRB was expected to be ready on November 29. (For a more detailed statement of the purpose and composition of the EJC Engineering Man-Power Commission see page 930 of the November issue.)

EJC Publicity

At the request of the chairman, Hartley W. Barclay of *The New York Times*, a frequent observer at EJC meetings, urged more effective publicity of EJC affairs. There was a persistent tendency on the part of the public, he said, to submerge the importance of engineers and their work and to confuse them with technicians. He advised the Council to place on its agenda for every meeting an important item that would emphasize the true status of engineers and to prepare, periodically, for the press, a statement of policy or position. The shortage of engineering man power (see page 1017 of the December issue) was an important current example of what he had in mind.

ASCE Forms Engineering Mechanics Division

ORGANIZATION of a new engineering mechanics division of the American Society of Civil Engineers was recently announced.

The objective of the new specialty group is to foster "activity and development in applied mechanics and other basic branches of knowledge."

Chairman of the division's executive committee is L. E. Grinter, Mem. ASME, research professor of civil engineering and mechanics, Illinois Institute of Technology, Chicago, Ill. Other members are: Arthur T. Ippen, Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass.; Nathan M. Newmark, Mem. ASME, University of Illinois, Urbana, Ill.; Ralph E. Fadum, head, department of civil engineering, North Carolina State College, Raleigh, N. C., and Douglas McHenry, head of structural research section, Bureau of Reclamation, Denver, Colo.

Percy Good Dies

PERCY GOOD, director of the British Standards Institution, died on Dec. 2, 1950. Mr. Good was well known by many members of The American Society of Mechanical Engineers because of his work on international standardization. He was instrumental in establishing working agreements by which the ASME and the British Standards Institution exchanged drafts of proposed codes and standards.

Simplification Was Big Question Before British Engineers in 1950

THE big question before the British engineering profession during 1950 was: Is British industry taking full advantage of simplification to achieve high productivity and low cost?

An answer to the question was recently published by the Anglo-American Council on Productivity of the Economic Cooperation Administration in a report "Simplification in British Industry." The report summarizes discussion at numerous trade and professional engineering meetings held earlier in 1950 in London, Birmingham, Glasgow, Manchester, and Sheffield. The meetings were organized for the purpose of discussing recommendations made by a group of British production experts who visited the United States in 1949 to study the basis of American industrial efficiency.

The 1949 report "Simplification in Industry," 25,000 copies of which have been distributed in Great Britain, explained how standardization (the process of organizing agreement relating to performance, quality, dimensions, or testing of a particular product); simplification (process of reducing number of types and variety of products made); and specialization (policy of devoting a particular facility exclusively to the manufacture of a narrow range of products), were used in American industry to achieve high productivity and low cost.

The British experts attributed American efficiency to four factors: (1) A highly developed cost consciousness among workers; (2) willingness of manufacturers to share knowledge developed in their plants; (3) a technical press which eagerly sought out production information and disseminated it among those who could put it to use; and (4) a sales policy which discouraged consumer preference for special sizes and products. (See pages 176–177, February issue of MECHANICAL ENGINEERING.)

On the basis of their observations the British team recommended five tasks for consideration of trade associations, and three steps which individual firms could take to promote higher productivity and lower costs.

The summary of discussion based on these recommendations, reported in the second productivity report, shows that British industry is keenly interested in simplification and that much has been accomplished and more is in the planning stage.

Few British companies which produce a variety of products know accurately the cost of producing them, the report brings out. As a consequence, needless variety is being maintained and encouraged. A truer assessment of overhead costs especially in plants taking special or small orders was recommended.

In plants where complete itemized costing was prohibitive, spot checks from time to time were suggested. More accurate costing reflected in selling price would serve as a powerful stimulus to eliminating superfluous variety in product design.

Selling

Much interest was reported in the common conflict between a sales policy which encourages new products and special orders and a production program for cost reduction. Top management, the report pointed out, must give more attention to integrating its sales and production policies.

Some fear was expressed at the meetings that simplification would result in an inadequate choice for the consumer. According to the British team, however, no appreciable reduction in the variety offered to the consumer should be expected because greater concentration by a given producer on a narrower range of type does not imply less total variety.

Some saw in greater simplification a deterioration of quality. On this point the report states:

"This is an all too common delusion arising no doubt from the fact that mass production is sometimes shoddy. Quality is a question of the setting of standards and adhering to them. With proper methods of production, control, and inspection, there is likely to be more constant quality and a smaller deviation from standards with the long run than with the short run. Length of run is increased by simplification."

British Progress

The meetings brought out considerable activity in British industry in simplification. For example, in the iron and steel industry a study was under way examining the possibility of recasting a wide range of steel standards on the basis of properties rather than on customer's requirements. The need is co-operation of users, many of whom maintain private specifications and thus defeat simplification. Substantial progress was expected from this effort.

In the machine-tool industry the trend for many years has been toward specialization. Manufacturers are tending to specialize in a narrow range of machines. Recently the industry organized an "exchange of parts" list as a means for establishing how many parts were common to the products of different manufacturers.

Another recent British study showed that many of the 260 tungsten-carbide-tipped tools in common use were unnecessary. The number was reduced to 116 without inconvenience to consumers.

In connection with nuts and bolts, screws, and rivets, the report has to say:

"The industry claims to have gone further in simplification than the corresponding industrial fasteners' industry in the United States. There are British standards laying down one type of bolthead and nut for a given bolt, where in the United States three or four types are in use. This is typical of the reduction in variety which has been carried out in this country."

Copies of the report may be obtained free from Economic Co-operation Administration Technical Assistance, New York Field Office, 2 Park Avenue, Suite 1221, New York 16 N. Y.

Second Industry-College Conference to Take Up Engineering Man Power

THE Second Industry-College Conference sponsored jointly by the Relations With Industry Committee of the American Society for Engineering Education and the Case Institute of Technology will be held at Case Institute, Cleveland, Ohio, Jan. 20, 1950. The conference, which will consider problems of mutual concern to industry, colleges, and the Armed Forces, will have as its theme "The Engineer and National Security."

Speakers reflecting each of the three points of view represented in the conference will constitute the program for the opening session. Francis M. Dawson, dean, College of Engineering, State University of Iowa, Iowa City, Iowa, who is president of the American Society for Engineering Education, will discuss "Function of the Engineering College—Its Immediate Past and Possible Future." G. M. Read, Mem. ASME, chief engineer for E. I. du Pont de Nemours & Company, will speak on "Industry's Need for Engineers and Scientists." Maj. Gen. Lewis B. Hershey, director of Selective Service, will discuss scientists and engineers in the military establishment.

The afternoon program will consist of three simultaneous panel sessions. M. M. Boring, Mem. ASME, manager of the technical personnel division of the General Electric Company, will preside over a panel that will discuss "The Supply of and Need for Engineering Man Power." Edward N. Cole, plant manager of the Cleveland Tank Plant, Cadillac Motor Car Division, General Motors Corporation, will head a discussion of the topic "Implementing Engineering Co-Operation for National Defense."

C. J. Freund, Mem. ASME, dean, College of Engineering, University of Detroit, will have the chair during a panel discussion on "The Effect of National Security on the Young Engineer."

The arrangements for the Second Industry-College Conference have been made by an executive committee of which Elmer Hutchisson, dean of the faculty and acting president of Case Institute, is honorary chairman. George K. Dreher, executive secretary of the Foundry Educational Foundation, is chairman of the executive committee which also includes William Culbertson, assistant to the president of Case Institute; Martin J. Bergen, Mem. ASME, chief draftsman, E. I. du Pont de Nemours & Company; and Douglass W. Miller, executive secretary of Case Institute.

The first industry-college conference was held in March, 1950, at Swarthmore College, Swarthmore, Pa.

United Engineering Trustees Report for 1949–1950

Facts About Building, Engineering Societies Library, and Engineering Foundation

THE Annual Report of the United Engineering Trustees, Inc., for 1949–1950 was issued on Oct. 26, 1950, by Edward C. Meagher, president UET. Excerpts from Mr. Meagher's report follow:

United Engineering Trustees, Inc. was chartered by the Legislature of the State of New York in 1904 with members appointed by the Founder Societies to conduct the joint interests of these societies in "the advancement of the engineering arts and sciences in all their branches, and to maintain a free public engineering library."

Engineering Societies Building, dedicated in 1907, a gift from Andrew Carnegie as a home for the engineers, has served us well for 43 years. It is solidly built. Its fortresslike shell is a monument to the integrity of the builders and workmen of that day. The weak spots are in those items subject to mechanical wear and tear, such as windows and doors, elevators, and chairs in the meeting halls and auditorium. Our continued occupancy of this building will at an early date, require extensive expenditures in these items which may eat deeply into our Building Depreciation Reserve as the only money available for such replacements.

The current assessment valuation of our property is $910,000 of which $410,000 is for land and $500,000 for building. Our legal counsel has a current ruling that the new state law covering tax-exempt corporations will not affect us, that we retain our tax exempt status.

The value of the Building Depreciation Reserve fund is of increasing importance in considering a new building. After the budgeted and usual allotment this year of $20,000.00 and the income amounting to $35,093.38 the value of the reserve at the end of the past year was $766,785.65. When we sell our present building and add the receipts to this reserve, we will have probably $1,500,000 to apply either toward a new structure, or as a nucleus for a substantial depreciation reserve on the new property.

ASME members on the UET Board of Trustees are K. W. Jappe, R. F. Gagg, and Warner Seely.

The Engineering Societies Library

In his annual report to the Library Board, Ralph H. Phelps, director, Engineering Societies Library, New York, N. Y., stated there was little change in the number of persons coming to the Library, but there was some decrease in the number of users of the paid services until the last month of the fiscal year, when there was a definitely noticeable increase in demand.

	1948–1949	*1949–1950*
Visitors served, total	22,921	22,283
Nonvisitors served, total	15,908	14,618
Total	38,829	36,901
Photostat orders	3,986	3,636
Photostat prints	47,377	43,094
Microfilm orders	174	153
Searches and paid services	139	128
Translations	61	100
Words translated	126,005	92,249
Borrowers	1,687	1,769
Books lent	2,343	2,534
Telephone inquiries	6,606	5,842
Letters written (exclusive of book orders)	3,255	2,990

For many years the Library has made confidential literature searches as ordered by individuals or companies wanting information on a special problem. In addition to this service, two years ago the Library started to issue a series of general-interest bibliographies available for purchase by anyone. The favorable comments and the growing demand for these bibliographies shows the value of the service. Bibliographies issued so far cover the following subjects: Filing systems for engineering offices, prestressed reinforced concrete, the lost-wax casting process, pallets for material handling, machinery foundations, and nonmetallic bearings.

The increased number of books and periodicals published makes the problem of selection of new material more difficult. The need to conserve space makes it essential that only the most important material be kept. Because of these two factors, new periodicals are even more thoroughly studied than heretofore, before a subscription or exchange is arranged. If there is the slightest doubt of its value, it is again studied before it is cataloged and bound.

All exchange and subscription lists have been again examined. Gift periodicals too are being examined more rigorously than ever. Even so, the Library now receives nineteen more periodicals than a year ago, but the amount of binding has been reduced. We believe that the material in the Library is being upgraded by this work.

Little-used material already in the collection is being withdrawn in larger quantity than ever before. This year 1153 volumes were withdrawn. Last year 409 were withdrawn and the total for the five preceding years was 138. To save time, no count was made of catalog changes resulting from the withdrawal of the 1153 volumes but probably 5000 cards had to be removed or changed.

As of Sept. 30, 1950, the Library stock consisted of 168,631 volumes; 11,958 maps; and 5171 searches. New acquisitions during the year were 1958 volumes, 747 maps; 63 searches, and 2640 pamphlets.

Over half of the items kept were outright gifts to the Library, given without expectation of review or other benefit. They came from many friends giving as individuals and also on behalf of societies, companies, libraries, and schools. Their gifts make the Engineering Societies Library a much better library. This is especially true because it is difficult or impossible to get some of the material through the usual commercial channels.

J. S. Thompson and Theodore Baumeister are representing The American Society of Mechanical Engineers on the Engineering Societies Library Board. Mr. Thompson is chairman of the Board. Mr. Baumeister is serving on the Administrative Committee.

The Engineering Foundation

In his annual report to the UET, Frank T. Sisco, technical director of the Engineering Foundation stated:

During the year that ended on Sept. 30, 1950, the Engineering Foundation sponsored and made grants toward the support of fourteen projects. Three of these were new. The other eleven were projects that had received Foundation support in 1948–1949 or in previous years. The Foundation Board, at its semi-annual meeting on June 16, 1949, approved the recommendations that its Research Procedure Committee made on May 18, 1949, regarding contingency ratios for the outside support required for most Foundation grants, and these contingency ratios were in general adhered to in making grants for the fiscal year 1949–1950.

Of its available funds for 1949–1950 the Foundation appropriated $27,500 for these fourteen projects; $941,235 was contributed by industry and other participants. The share of the Foundation was slightly less than three per cent; in other words, out of each dollar spent on Foundation research projects during the fiscal year just ended, industry and others supplied a little more than 97 cents.

ASME Projects

Three projects were sponsored by The American Society of Mechanical Engineers, all of them relatively old and well established. The research on Fluid Meters (project 30), which started in 1935, received a Foundation grant of $1000 and collected $14,000 from other sources. Work on the Plastic Flow of Metals (project 68), which has been going on continuously since 1936, was granted $1500 contingent on raising $7500 from industry and others. This requirement was easily met. The third project, on Furnace Performance Factors (project 82), which began in 1943, was active during the year and had a total income from industry in excess of $57,000. The Foundation grant of $1500, which was made for the specific purpose of analyzing the numerous data obtained by furnace tests, was not used, as the analysis had to be postponed because of the desirability of making another series of test runs during the year.

The Foundation grants for 1949–1950 for the Founder Societies were as follows: ASME,

$4000; ASCE, $10,500; AIME, $7000; Joint activities, $6000.

Co-Operation With NRC

The Engineering Foundation co-operates with the Division of Engineering and Industrial Research of the National Research Council. In his report on the NRC Conference on "Primary Publication," Mr. Sisco stated:

"The purpose of this conference was to discuss ways and means of expanding scientific and technical publication facilities in order to take care of the recent greatly increased number of available reports of research in the face of rapidly rising publication costs. Also discussed at length was the question of the relation of available government funds for publication to technical and scientific journals, and other related subjects. The conference was attended by representative editors, research directors in industry, and the Government, and publishers. Although no panaceas resulted from the meeting, the free exchange of opinions and the many constructive suggestions that were advanced for a partial solution of the problems made the conference well worth while for those in attendance."

Soil Mechanics

Over a period of 20 years the Foundation has contributed $55,000 and industry $57,000 to a project on "Earths and Foundations." As a result of this research, a text and reference book has been prepared entitled "Subsurface Exploration and Sampling of Soils for Civil Engineering Purposes." The manuscript, written by Juul Hvorslev, contains 521 pages, 379 illustrations, and a bibliography of 600 references. The volume may be purchased from the ASME Order Department. Price is $4 to members of the Founder Societies and $6 to others.

ASME representatives on The Engineering Foundation are: K. W. Jappe, E. L. Robinson, and Herman Weisberg.

Fire Protection Engineers Organize Society

ORGANIZATION of the Society of Fire Protection Engineers, a new, professional section of the National Fire Protection Association, was announced recently.

The object of the society is to promote the professional standing of fire-protection engineers.

Officers elected at the initial meeting in Boston, Mass., are: *President*, John J. Ahern, director, department of fire protection and safety engineering, Illinois Institute of Technology; *first vice-president*, John A. Neale, Mem. ASME, chief engineer, National Board of Fire Underwriters; *second vice-president*, Elmer F. Reske, manager, Cook County Inspection Bureau; *secretary*, Robert S. Moulton, technical secretary, National Fire Protection Association; *assistant secretary*, Richard E. Stevens, National Fire Protection Association.

Meetings of the Society will be held in connection with the regular annual meeting of the NFPA and at other times as may be determined by the membership.

Government Financed Research Potential Hazard, Chemical Engineers Warned

T. H. Chilton Elected 1951 AIChE President

THE HIGH percentage of all research work being financed by the Government, particularly the military services and the Atomic Energy Commission, is a potential hazard to the country, according to E. R. Gilliland, professor of chemical engineering, Massachusetts Institute of Technology, and former assistant rubber director in charge of research and development in the Office of the Rubber Director. Professor Gilliland is the 1950 winner of the Celanese Corporation of America Professional Progress Award in Chemical Engineering. He spoke before the annual meeting of the American Institute of Chemical Engineers held recently in Columbus, Ohio.

"There are several aspects of this problem that are dangerous," Professor Gilliland said, "First, there is a tendency to channelize research and development work into certain research fields at the expense of others of equal importance. In fact, some of the neglected fields will probably be of more importance in a real emergency than some of those being actively pushed. Second, a considerable portion of it is not research, but is development work."

With the armed services having something of the order of two billion a year at their disposal for research and development, or about twice the total for industry and universities, the speaker asserted, the government-sponsored research must involve the effort of a large proportion of the scientists and engineers of the country.

"I seriously question," Professor Gilliland said, "whether the military services have sufficient background in the evolution of modern science and engineering to direct a major part of the research effort of the country even for their own greatest benefit. As a result of serving on several committees and panels of the Research and Development Board of the Defense Department, I am even more concerned about the lack of any real study of the implications of this vast program.

"We have a major obligation to our country, particularly in its defense and security. However, I am concerned over the fact that one of the main contributions of science and technology is for destructive purposes. I hope that the public does not arrive at the conclusion that the chief contribution of our field is destruction.

"While technically trained people are a necessity in modern warfare, I hope that we can sell the public the view that our main contributions are for the social good and not for destruction. I believe we should make a real effort along this line.

"It is frequently said that science and technology are neutral and that the harmful effects are only in the way they are applied. I do not agree with this philosophy. To a considerable degree the different phases of technological endeavor can be differentiated as to those that are likely to make sociological improvements as compared to those that would make their major effect along military lines," Professor Gilliland said.

New Officers Announced

Thomas H. Chilton, Mem. ASME, technical director of the development engineering division, E. I. du Pont de Nemours and Company, was elected president of the AIChE for 1951.

Four new directors were elected. They are Charles R. Nelson, manager of the process engineering department of the Shell Development Company, Emeryville, Calif.; Earl P. Stevenson, president of Arthur D. Little, Inc., Cambridge, Mass.; R. C. Gunness, manager of research of the Standard Oil Company, (Indiana); and R. Paul Kite, manager of the development department The Dorr Company.

Low-Pressure Hydrogenation Process

In another paper, B. L. Clark of the U. S. Bureau of Mines, said that soon it may be possible to produce fuel oil locally in such oil-arid localities as Alaska, South Africa, and Australia through the liquid-phase hydrogenation of coal.

Improvements in the process described by Clark have made it possible to produce a usable fuel oil at 1500 pounds pressure, representing a 3 to 6-fold reduction from previously developed high-pressure processes. The lower pressure permits the use of welded equipment and more available piping materials instead of the heavy forgings and special piping and valves required for the existing high-pressure process. Such simplification in process equipment may make it feasible, according to Mr. Clark, to produce fuel oil locally in regions where petroleum is scarce, but where coal is plentiful. This would relieve the stress on U. S. and Allied merchant shipping in time of emergency, in addition to providing a supply of oil during normal times for those localities.

Perceptual Unity

Another paper of general interest was on "Visual Perception and Learning," by H. L. Sherman, professor, Ohio State University, Columbus, Ohio, who showed the engineers present how to see more things at a glance by a method used in the past on football players, military men, and art and dentistry students. Professor Sherman demonstrated how "perceptual unity," the simultaneous seeing of all things in the field of vision, can be taught by flash-exposure methods.

A player, with a cardboard mask over his face, would stand on the field ready to throw. Professor Sherman, standing behind him at the other end of a string connected to this mask, would suddenly yell "red" and pull the string. The mask would rise for an instant, and the ball would be on its way through the air. Some twenty yards away, four prospective receivers wearing different colored jerseys would be running at top speed. The one in the red jersey would catch the ball without much effort.

1950 ASME Membership List Available

THE 1950 issue of the Membership List, AM-1, of The American Society of Mechanical Engineers will be published early in January, 1951.

The new list will contain about 35,000 names of members arranged alphabetically with addresses, professional titles, and company affiliation. A geographical list containing names of members only will also be included.

ASME members may obtain copies by writing to the Secretary, ASME, 29 West 39th Street, New York 18, N. Y. Please use code designation, AM-1, when referring to the Membership List.

Col. A. Antoine Honored at Luncheon

COL. A. Antoine, inspector general, of Électricité de France, Paris, president of the World Engineering Conference, and leader in organizing the Engineering Congress in Paris in 1946, was guest of honor at a luncheon held in The Engineers' Club, New York, N. Y., on Nov. 6, 1950, with representatives of the Engineers Joint Council, the United Engineering Trustees, Inc., and the engineering societies.

After the luncheon Colonel Antoine spoke of his desire to see international relations of engineering groups made effective through whatever kind or kinds of organizations can best accomplish that purpose. He spoke briefly of the Union of International Engineering Organizations recently set up under the sponsorship of UNESCO which includes such well-known organizations as the World Power Conference, International Commission on Large Dams, International Conference on Large Electric Systems, International Railway Congress Association, and others.

Électricité de France (EDF) is a public agency with legal and financial autonomy and has both industrial and commercial characteristics. It is entrusted with the production, transmission, and distribution of electric energy for the whole of France. It takes part, through its technical departments, in any research or construction work on power projects in the Overseas Territories of the French Union.

In January, 1951, Colonel Antoine will present a paper, "Co-Ordination Between a Country's Development Plan and Its Policy of Electric Power Equipment," at the Sectional Session of the World Power Conference to be held at New Delhi, India.

Education

THE critical need for engineers by industry and the Armed Forces recently caused the Rensselaer Polytechnic Institute, Troy, N. Y., to return to the three-semester year. The first mid-year class since the last war will be enrolled on Feb. 1, 1951, and will be composed of January high-school graduates.

IAS Opens Goddard Exhibit

THE Goddard Memorial Exhibit was formally opened on Dec. 1, 1950, at the Aeronautical Museum of the Institute of the Aeronautical Sciences, 2 East 64th Street, New York, N. Y. Among those attending were Mrs. Esther C. Goddard, widow of the late Robert H. Goddard, pioneer rocket engineer, leaders in the rocket and aviation fields, and officers and members of the American Rocket Society.

Dr. Goddard's entire library on rocket propulsion, including his own records of his experiments, and hundreds of the actual rocket parts and mechanisms tested in the course of his work have been presented to the IAS by Mrs. Goddard and are a part of the permanent exhibit of the museum. The collection includes a prototype of a "bozooka" which was developed and ready for production by the end of World War I, as well as many examples of successful and unsuccessful liquid-fuel rocket motors, controls, tanks, instrumentation, firing mechanisms, fuel pumps, and turbines from Dr. Goddard's experimentations at Auburn, Mass., Roswell, N. M., and Annapolis, Md., in World War II. Completing the exhibit are some of the latest JATO and rocket engines, loaned by the United States Navy and Reaction Motors, Inc., Dover, N. J. These are typical of further developments in the field of rocketing since Dr. Goddard's death.

Dr. Goddard may justly be called the "Father of Rocketing," for he began his developmental work of rockets about 1909, and many of the ideas currently being tested by rocket engineers were first proposed by him. It is interesting to note that the German V-2 rocket was developed along lines nearly identical to missiles that had been flight-tested by Dr. Goddard prior to World War II.

Professional Standing of The Engineer

PROFESSIONAL standing is a subject on which a few top engineers do some hard thinking but which most engineers toss off as unimportant, Clement J. Freund, dean, college of Engineering, University of Detroit, Detroit, Mich., recently told a meeting of the Saginaw Valley Chapter of the Michigan Society of Professional Engineers.

The professional man, in the opinion of authorities, Dean Freund said, was such to the extent that he was motivated by a desire to serve his fellow men; and an engineer was not professional to the extent that he had no interest in his fellow men.

An engineer may become the world's authority in reinforced concrete or in the metallurgy of alloy steel, or in jet engines, or in the refining of petroleum, or in aerodynamics, but he would never become professional if he had no concern for the well-being of the community.

Dean Freund said that he considered the most important item in the professional engineer's relation to his fellow men was a keen sense of right and wrong. The engineer's understanding of science and applied science gave him control over the life and death of his fellows. The atomic bomb was an obvious example. When anybody had that much power over his fellows, it was of tremendous consequence that he should possess a sensitive moral judgment, Dean Freund said.

Meetings of Other Societies

Jan. 8–12
Society of Automotive Engineers, annual meeting and engineering display, Hotel Book Cadillac, Detroit, Mich.

Jan. 18–20
Society of Plastics Engineers, Inc., seventh annual national technical conference, Hotel Statler, New York, N. Y.

Jan. 22–26
American Society of Heating and Ventilating Engineers, 57th annual meeting, Hotel Bellevue-Stratford, Philadelphia, Pa.

Jan. 22–26
American Institute of Electrical Engineers, winter meeting, Hotel Statler, New York, N. Y.

Jan. 29–Feb. 1
Institute of the Aeronautical Sciences, 19th annual meeting, Hotel Astor, New York, N. Y.

(For ASME Calendar of Coming Events see page 91)

U. S. Signal Corps Needs Mechanical Engineers

THE Army Signal Corps is looking for mechanical engineers to work on designs, developments, procurement, operating, and testing of various types of communication equipment. An engineering degree is a minimum requirement. Starting salary range is $3100 to $5400. Write to Civilian Personnel Branch, Building T-530, Fort Monmouth, N. J., for further information.

Notes on Coming Meetings

Air Conditioning

A VARIETY of new products will be displayed at the 10th International Heating and Ventilating Exposition in the Commercial Museum, Philadelphia, Pa., Jan. 22–26, 1951. The exposition is under the auspices of the American Society of Heating and Ventilating Engineers.

* * *

Industrial Engineering

THE third annual Industrial Engineering Institute will be co-sponsored by the San Francisco Section of The American Society of Mechanical Engineers, and the University of California, to be held, Feb. 2–3, 1951, in Berkeley, Calif. The two-day meeting will include sessions on work simplification, time study, standard data systems, production engineering, and human engineering, and are slanted toward practical methods of cost reduction. Among the speakers who will participate are: R. Conrad Cooper, vice-president, U. S. Steel,

Pittsburgh, Pa.; E. P. De Garmo, Mem. ASME, professor of mechanical engineering, University of California; William Gomberg, Mem. ASME, director, Management Division, ILGWU, New York, N. Y.; and Ralph M. Barnes, Mem. ASME, professor of engineering and production management, University of California at Los Angeles.

Industrial Personnel

A CONFERENCE on Industrial Personnel will be held at Columbia University, March 19–23, 1951. It is the first of the 1951 series of conferences on various phases of industrial organization and management to be sponsored by the Department of Industrial Engineering. Prof. William W. Waite, Mem. ASME, head of personnel area of the Columbia Department of Industrial Engineering, will serve as director of the conference.

Management

THE Ninth International Management Congress under the sponsorship of the International Committee of Scientific Management (CIOS) will be held in Brussels, Belgium, July 5–11, 1951. Of the twelve subjects to be discussed, the U. S. National Committee will be responsible for presentation of four. They are: Methods of establishing production standards, advance procedures in public administration, education for management, and work simplification.

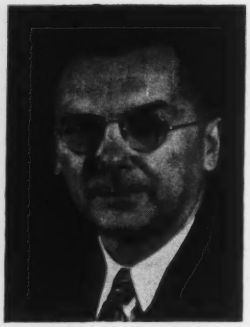
People

H. L. Dryden Named 1950 Guggenheim Medalist

HUGH LATIMER DRYDEN, Fellow ASME, director, National Advisory Committee for Aeronautics, was named the recipient of the Daniel Guggenheim Award for 1950, in an announcement made jointly by The American Society of Mechanical Engineers, Institute of the Aeronautical Sciences, and Society of Automotive Engineers. The presentation will take place on Jan. 29, 1951, at the IAS honors night dinner at the Hotel Astor, New York, N. Y. The award is presented annually for notable achievement in the advancement of aeronautics.

Born in Pocomoke City, Md., July 2, 1898, Dr. Dryden was educated at The Johns Hopkins University, receiving an AB degree in 1916, MA in 1918, and PhD in physics in 1919. He began his aeronautical career as a laboratory assistant with the National Bureau of Standards. During his 19 years with the Bureau he became successively chief of the Aerodynamics Section, chief of the Mechanics and Sound Division, and associate director. He was appointed director, NACA in 1947.

Among the honors that have been accorded Dr. Dryden are the 1940 Sylvanus Albert Reed Award from the IAS, the Presidential Certificate of Merit, and the Medal of Freedom. In



H. L. DRYDEN, 1950 GUGGENHEIM MEDALIST

1938 he gave the IAS annual Wright Brothers Lecture on the subject, "Turbulence and the Boundary Layer." He delivered the 37th Wilbur Wright Memorial Lecture before the Royal Aeronautical Society in London in 1949. His subject on this occasion was "The Aeronautical Research—Goals, Methods, and Accomplishments."

He is the author of technical books and has contributed articles, reports, and bulletins to scientific journals. He has served on various committees dealing with guided missiles. Since 1941 he has been editor of the *Journal of the Aeronautical Sciences*.

Dr. Dryden has served The American Society of Mechanical Engineers as member and chairman of the executive committee of the Applied Mechanics Division, the Publications Committee, and several others. He is a member of many other engineering and scientific organizations.

* * *

L. J. MARKWARDT was elected president of the American Society for Testing Materials for 1950–1951. Other officers elected were: T. S. Fuller, vice-president; B. A. Anderton, Robert H. Brown, D. K. Crampton, Harry G. Miller, Mem. ASME, and J. R. Trimble, members of the board of directors.

* * *

GROVER LOENING, aviation engineer and aeronautical consultant, was named 1950 winner of the Wright Brothers Memorial Trophy by the National Aeronautical Association. The award is to be presented at the annual Wright Brothers Memorial Dinner to be held at the Aero Club of Washington, Washington, D. C., Dec. 16, 1950. Mr. Loening is the inventor of the strut-braced monoplane and holds many aviation patents.

* * *

HAROLD S. SIZER, Mem. ASME, assistant to the director of design, Brown and Sharpe Manufacturing Company, Providence, R. I., was elected to the board of directors, American Standards Association, to serve a three-year term beginning Jan. 1, 1951.

HOWARD COOPER, Mem. ASME, was recently elected president of the National Lubrication Grease Institute. Mr. Cooper is chief lubricating engineer, Sinclair Refining Company, New York, N. Y.

* * *

REAR ADM. LAWRENCE B. RICHARDSON, USN (Ret.), director of research and development, Fairchild Aircraft Division, Fairchild Engine and Airplane Corporation, was elected president of the Institute of Aeronautical Sciences for the year 1951.

* * *

THOMAS M. FALLON, formerly advertising manager of the Machinery Division, Dravo Corporation, Pittsburgh, Pa., has been appointed publishers' representative of The American Society of Mechanical Engineers. He will represent MECHANICAL ENGINEERING and ASME Mechanical Catalog in Western Pennsylvania, Ohio, and West Virginia. His offices are located in the May Building, Pittsburgh, Pa.

* * *

PAUL W. KIEFER, Fellow ASME, chief engineer of equipment, New York Central System, New York, N. Y., was awarded a George R. Henderson Medal at the annual medal-day exercises of The Franklin Institute held Oct. 18, 1950, in Philadelphia, Pa. This medal is awarded for meritorious inventions or discoveries in the field of railway engineering.

* * *

THEODOR VON KÁRMÁN, Mem. ASME, honorary professor, Columbia University; chairman of the Scientific Advisory Board of the USAF; consultant of the Aerojet Engineering Corporation, Azusa, Calif.; ASME Medalist, 1941, was named recipient of the Kelvin Gold Medal for 1950 in a recent announcement by The Institution of Civil Engineers. This medal, first awarded in 1920, is awarded triennially in memory of Lord Kelvin to men of distinguished service in the application of science to engineering rather than in the development of physical science itself.

THEODOR VON KÁRMÁN, 1950 KELVIN MEDALIST

To ASME Members:

Nominations Open for 1952 Officers

This Matter Is Important to You!

THE 1951 National Nominating Committee of the Society is receiving proposals for candidates for the offices to be filled for 1952. It is the obligation, privilege and responsibility of every member of the Society to assist the Committee in obtaining the best men available. You can do your part by acting as a sponsor for those members who have the acknowledged qualities of outstanding ability and leadership in their profession.

Offices to Be Filled

President	To serve 1 year
Vice-President	To serve 2 years, Region I
Vice-President	To serve 2 years, Region III
Vice-President	To serve 2 years, Region V
Vice-President	To serve 2 years, Region VII
Directors at Large (2)	To serve 4 years

Act Now!

Proposals will be welcomed by the Committee.

1 Proposed candidates names and records should be submitted on the official proposal form which may be obtained from the Secretary of the National Nominating Committee or any of its members listed below.

2 Completed forms in the required number of copies should be sent to the Committee through the Secretary, Paul T. Onderdonk, Consolidated Edison Company, 4 Irving Place, New York 3, N. Y., not later than April 1, 1951.

3 The proposer, not the proposed candidate, should fill out the form.

4 Before submitting the name of a proposed candidate, his consent in writing should be obtained and be submitted with the proposal.

Members are reminded that, in accordance with the Society's Constitution, candidates for office of President, Vice-President and Director at Large shall be of the grade of Fellow or Member.

Members wishing to speak in support of any proposed nominee have the privilege of appearing before the National Nominating Committee at open hearings to be held during the Semi-Annual Meeting in Toronto, Ontario, Canada, June 11–15, 1951, Hotel Royal York.

1951 National Nominating Committee

Region I: A. J. Ferretti, Northeastern University, 360 Huntington Ave., Boston 15, Mass.; Charles H. Coogan, Jr., *1st Alt.*, Mechanical Engineering Department, University of Connecticut, Storrs, Conn.; Harry E. Harris, *2nd Alt.*, 229 Thorme Street, Bridgeport 6, Conn.; and David A. Fisher, *3rd Alt.*, Mechanical Engineering Department, University of Connecticut, Storrs, Conn.

Region II: Paul T. Onderdonk, secretary, Consolidated Edison Company of New York, Inc., 4 Irving Place, New York 3, N. Y.; Kenneth J. Moser, *1st Alt.*, Stevens Institute of Technology, Hudson St., Hoboken, N. J.; W. H. Byrne, *2nd Alt.*, Byrne & Associates, Inc., 140 Nassau Street, New York 7, N. Y.

Region III: William G. McLean, Department of Mechanics, Lafayette College, Easton, Pa.; Charles C. Di Ilio, *1st Alt.*, Mechanical Engineering Department, The Pennsylvania State College, State College, Pa.; and C. B. Campbell, *2nd Alt.*, Steam Division, Westinghouse Electric Corporation, Lester Branch P.O., Philadelphia 13, Pa.

Region IV: J. A. Keene, Alabama Power Company, 600 N. 18th St., Birmingham 2, Ala.; E. M. Williams, *1st Alt.*, Clinchfield Fuel Company, Box 410, Spartanburg, S. C., and J. Marshall Johnson, *2nd Alt.*, Tennessee Valley Authority, Power Building, Chattanooga, Tenn.

Region V: F. F. Borries, Westinghouse Electric Corporation, 207 W. 3rd St., Cincinnati, Ohio; C. R. Davis, *1st Alt.*, Davis Automatic Controls, Ltd., 5 Blackmore St., Toronto 5, Ont., Canada; Henry S. Walker, *2nd Alt.*, Detroit Edison Company, 2000—2nd Ave., Detroit 26, Mich.

Region VI: H. A. Bolz, General Engineering Department, Purdue University, Lafayette, Ind.; Robert T. Mees, *1st Alt.*, Research Department, Caterpillar Tractor Company, Peoria 8, Ill.; and Harold L. Heywood, *2nd Alt.*, Kearney & Trecker Corporation, 6784 W. National Ave., West Allis 14, Wis.

Region VII: W. A. Pearl, Mechanical Engineering Department, Washington State College, Pullman, Wash.; F. B. Lee, *1st Alt.*, c/o Fairman B. Lee Co., 219 Central Bldg., Seattle 4, Wash.; A. R. Weigel, *2nd Alt.*, Consolidated Western Steel Corporation, 5700 S. Eastern Ave., Los Angeles 54, Calif.

Region VIII: Venton L. Doughtie, chairman, The University of Texas, University Station, Austin 12, Texas; Arnold R. Mozisek, *1st Alt.*, c/o Dallas Power & Light Company, 1506 Commerce Bldg., Dallas 1, Texas; and Robert P. Lockett, Jr., *2nd Alt.*, A. M. Lockett & Company, 308 Whitney Bldg., New Orleans, La.

ASME NEWS

Atlanta Section Prepares for 1951 ASME Spring Meeting

THE Atlanta Section of The American Society of Mechanical Engineers will be host at the 1951 Spring Meeting of the Society to be held at the Atlanta Biltmore Hotel, April 2–5, 1951.

The 1951 Region IV Administrative Committee Meeting will be held on Sunday, April 1, followed by the Student Branch Conference for Region IV which will be held at the Hotel Biltmore on Monday, April 2. The technical program will consist of 18 sessions sponsored by the Power, Process Industries, Hydraulic, Materials Handling, Fuels, Heat Transfer, Textile, and other Divisions and technical committees of the Society.

The Atlanta Section is also planning a series of plant trips to local industries that will include the Electric Storage Battery Company, the Cocoa Cola Company plant, Atlantic Steel Company, and a trip to the Allatoona Dam some forty miles from Atlanta.

Some of the papers scheduled for presentation cover such subjects as "Evaluation of the Industrial Engineering Curriculum," "Placement of Engineering College Graduates," "Utilization of Wood Wastes," "Frozen Food Packaging," and others.

Industrial Center of the South

Atlanta was founded in 1837 as Terminus. Later the name was changed to Marthasville. Today metropolitan Atlanta covers an area of 1173 square miles and has a population of more than 600,000.

Following the great Cotton Exposition in 1881 and the Piedmont Exposition in 1887, the attention of the world was focused upon Atlanta in 1895 through the Cotton States and International Exposition. Visitors found Atlanta a progressive city, and many returned to become a part of its prosperity.

Today Atlanta boasts some 1500 manufacturers producing over 3000 different commodities for the markets of the world. National American firms maintain in Atlanta 3300 branch, district, and division offices. There are nearly 1000 wholesale establishments with annual sales in excess of a billion and a half dollars.

In addition to its commerce and industry, Atlanta is one of the great cultural centers of the American South. It has seven white colleges and universities and seven Negro colleges. Atlanta claims to be the world's largest center of Negro education.

Members planning early vacations would do well to consider the ASME Spring Meeting for in Atlanta spring has a new dimension which escapes all definition.

Committees

The following committee is in charge of local arrangements for the meeting: Leslie F. Zsuffa, Claude L. Huey, *general chairmen;* Mario J. Goglia, *technical events;* Vincent F. Waters, *printing and signs;* Frank E. Markel, *hotel arrangements;* Roger A. Martin, *entertainment;* Lucius L. Pitts, *plant trips;* Robert F. Haller, *information and registration;* William D. Bishop, *publicity;* John H. Rittlemeyer, *reception;* Mrs. Paul H. Nichols, *ladies;* John H. Dodd, *finance;* S. D. Moxley, vice-president and chairman, Region IV Regional Administrative Committee Student Branch Conference.

Who Becomes an ASME Life Member?

AT THE 1950 Semi-Annual Meeting in St. Louis, Mo., the Council of The American Society of Mechanical Engineers amended the By-Laws and Rules pertaining to life membership, the amendments to become effective on Oct. 1, 1952.

Under the present By-Law, Article B5, Par. 12, which will expire in 1952, it is mandatory for Council to confer life membership on any Fellow, Member, or Associate of the Society (1) when he has paid dues for 35 years, or (2) when he has reached the age of 70 after having paid dues for 30 years.

In the amended By-Law, it will be mandatory for Council to confer life membership only on those Fellows, Members, and Associates who have paid dues for 35 years and who have in addition either reached the age of 65 or have retired from regular work.

Life membership can be purchased at any time by any Fellow, Member, or Associate by paying the Society at one time the present worth of an annuity equal to that member's dues for the period for which he is required to pay dues. In most cases this period will be longer under the amended By-Law effective October, 1952, than under the current one.

As in the present By-Law, student membership dues will not be considered as applying to the 35-year-dues payment.

In accordance with the new rule (Article B5 Rule 3) within six months after a Fellow, Member, or Associate has completed 35 years of dues payment, the Society will advise him of the amended life-membership provision and request him to notify the Society when he retires from regular work.

Process Division to Take up Air and Stream Pollution

THE Second Annual Conference of the Process Industries Division of The American Society of Mechanical Engineers will be held at the Lord Baltimore Hotel, Baltimore, Md., April 17–19, 1951.

Tentative plans call for four technical sessions, a welcome luncheon on the first day, a banquet on the second day, and a series of plant trips to representative industries of Baltimore on the third day.

The technical program will center about problems relating to abatement of air and stream pollution by industrial wastes. While specific papers cannot be announced, tentative commitments have been received from authors who have papers on selection of flow-metering equipment for measuring industrial wastes, and evolution of a bladeless surge and trash pump. Another author promises an account of interesting material-handling installations about Baltimore Harbor. A high light of the technical program promises to be a panel on air pollution at which experts from several industrial centers will exchange latest experiences.

Arrangements for the program are in charge of S. B. Sexton, chairman, Arthur Gompf, and Harland Hyde, of the ASME Baltimore Section, and J. H. E. Fedeler, chairman, E. L. Knoedler, and L. A. Dorgan, of the ASME Process Industries Division.

Woman's Auxiliary Honors Mrs. Purdy

MRS. Randall B. Purdy, president of the National Board of the Woman's Auxiliary to The American Society of Mechanical Engineers, was honored at a luncheon at the Engineering Woman's Club, New York, N. Y., Tuesday, Nov. 14, 1950. The luncheon was attended by members of the Auxiliary who have served on the Board with Mrs. Purdy, and members of the Philadelphia Section for which Mrs. Purdy is sponsor.

Mrs. William E. Karg, chairman, Philadelphia Section, presented Mrs. Earl B. Smith, Mrs. Rudolph F. Gagg, Mrs. Justin J. McCarthy, Mrs. Ernest A. Lundstrom, and Mrs. Frank W. Miller, each of whom spoke of Mrs. Purdy's fine qualities and leadership, and of the growth of the Auxiliary during the past two years.

Mrs. Miller, first vice-president, presented Mrs. Purdy with a silver serving tray, a token of esteem and affection from her associates. Mrs. Rudolph F. Gagg was in charge of arrangements.

Record Attendance at Members and Students Luncheon

IN THE grand ballroom of the Hotel Statler, New York, N. Y., on Thursday, Nov. 30, 1950, members of the ASME joined with student members from many sections for the 1950 Members and Students Luncheon. The hosts at each table introduced guests and a friendly hour was enjoyed among members and students.

Pres. James D. Cunningham was toastmaster. In his introductory remarks, President Cunningham said that he had decided he would never serve on any committee to select a paper for a student award. During his term of office he had heard many papers read and to him they all were excellent. He would have awarded each one of them a prize. He urged all student members to become interested in the Society and after graduation to join a local section.

Young Authors Honored

President Cunningham then introduced Edward Hopping, member of the ASME Board on Honors, who presented the Undergraduate Student Award to James N. Colebrook, Jun. ASME, for his paper "Design and Construction of a Pressure Transducer Testing Machine." (A biographical sketch of Mr. Colebrook appears on page 73.)

The Charles T. Main Award was won by Richard T. Johnson, who was unable to be present, for his paper "The Need for Conversion to a Five-Year Course in Engineering Instruction for the Bachelor's Degree in Order to Include Instruction in the Humanities and in Public Relations." (A biographical sketch of Mr. Johnson appears on page 72.)

President Cunningham remarked, in connection with the subject of this paper, that he agreed with it fully, and pointed out the need for teaching American history, referring to an article in the *Readers' Digest*. He said that *The New York Times* conducted a quiz in freshman classes in college last fall, and half of the students thought that Thomas Jefferson founded the *Saturday Evening Post*, Alexander Hamilton invented the telephone, and that Walt Whitman was a dance-band leader.

The toastmaster then introduced Frederick D. Herbert, chairman of the "Old Guard," whose members consist of those who have paid dues for more than 35 years and continue to do so even though they are freed from this obligation, so that a fund can be maintained to support the luncheon and to provide awards to students. This year the Old Guard contributed $150 toward the student-luncheon tickets.

The speaker at the luncheon was Arthur P. Adamson, Jun. ASME, recipient of the Pi Tau Sigma Gold Medal. His subject was "Technological Developments Shifting Boundary Line Between Electrical and Mechanical Engineering." A brief summary of his speech follows:

Electromechanical Course

Mr. Adamson said that he wanted to talk about the attitude of students toward the scope of the mechanical-engineering profession. "We might as well face the fact that a necessary by-product of the electrification of industry is the electrification of the mechanical engineer," he said. He decried the attitude on the part of mechanical engineers who say, "If electricity is involved in the problem, it is outside my field of interest." "It is apparent that the answer to this question is important to the young engineer," remarked Mr. Adamson, "because it will help you determine what jobs you should regard as yours and what jobs you should feel are really outside your legitimate field of interest. Furthermore, if there is really no boundary, you can feel free to attack any problem that appeals to you. I don't know where the boundary is between electrical engineering and mechanical engineering, and I doubt if there is one. But if there is, I am sure it is far over in the direction of electrical engineering." Mr. Adamson said the opposite view probably gets its start in colleges where the student sees that the electrical-engineering and the mechanical-engineering departments are physically separated and the student can choose to study one or the other. This separation is artificial and has outlived its usefulness. Mr. Adamson declared that specialization in colleges is futile and that college courses in both electrical and mechanical engineering should be combined into one electromechanical engineering course.

JAMES N. COLEBROOK, UNDERGRADUATE STUDENT AWARD WINNER (*left*) TALKING TO ARTHUR P. ADAMSON, PI TAU SIGMA GOLD MEDALIST

"The best course of instruction is one which thoroughly acquaints the student with the fundamental laws of nature and the tools with which these laws can be applied," he said. "He would then be better fitted for that unknown job in an unknown field in an unborn industry. Imagine how many engineers are employed today in the jet-engine, guided-missile, radar, and atomic-energy fields. These industries were virtually nonexistent ten years ago. I have known electrical engineers who spend all of their time on structural-design problems and mechanical engineers whose occupation is the design of electronic amplifiers. Such instances indicate the futility of specialization in college and indicate some of the gains to be expected if electric and mechanical-engineering courses are combined."

President Cunningham then introduced the new president of the ASME, J. Calvin Brown, who gave a brief talk on the great advances in industry from the early days of the American colonies to the present time, and commented on the great future open to the young engineers of the present day. He spoke of the founding of the ASME in 1880, and compared its small beginning with the great educational institution it is today.

At the speakers' table were George I. Rockwood, Fellow and Hon. Mem. ASME; Oliver V. S. Bulleid, Hon. Mem. ASME, from Dublin, Ireland; L. Austin Wright, general secretary, Engineering Institute of Canada; and C. E. Davies, secretary, ASME.

ASME Woman's Auxiliary Enjoys Interesting Program at 1950 Annual Meeting

Mrs. Frank W. Miller Elected President for 1951

THE 1950 Annual Meeting of The American Society of Mechanical Engineers marked the 27th anniversary of the Woman's Auxiliary of the ASME. A record registration of 400 added to the success of a splendid program arranged by the Metropolitan Section of the Auxiliary.

Officers for the Annual Meeting were: Honorary chairman, Mrs. Frank W. Miller; general chairman, Mrs. C. H. Kent; and general vice-chairman, Mrs. Sabin Crocker. Mrs. George W. High was chairman of registration.

All activities were well attended and enjoyed. On Monday the outstanding event was the annual tea dance held in the Georgian Room of the Statler Hotel, from 5 to 7 p.m. The chairmen for this delightful affair were Mrs. T. A. Burdick and Mrs. H. R. Kessler. Mrs. Crosby Field arranged for a group of young ladies to act as "Ask Me" girls, to provide dancing partners for the young men attending. The tables were beautifully decorated. Mrs. James D. Cunningham, honored guest, as well as Mrs. E. G. Bailey, Mrs. Frank W. Miller, Mrs. J. Noble Landis, Mrs. R. B. Purdy, Mrs. Ralph L. Morse, Mrs. Robert M. Gates, and Mrs. William Caldwell took turns pouring.

On Tuesday, a trip to the United Nations at Lake Success proved popular. Ninety-six ladies went to Lake Success, and many were able to get into the Security Council just after the seating of the Chinese Reds. Mrs. Sabin Crocker was chairman for this event.

On Tuesday, Mrs. A. M. Feldman was chair-

man of a trip to the Metropolitan Museum of Art to see "The World of Silk" exhibit. Luncheon in the Museum cafeteria was followed by an afternoon at the Cloisters. Mrs. Feldman also acted as commentator. A pleasant day was enjoyed by this group.

Wednesday was also a full day. National Chairman Mrs. R. B. Purdy, was hostess at a breakfast for the Section chairmen attending the Annual Meeting. The business meeting was presided over by Mrs. Purdy. Reports on the various Sections were given by the chairman, if present, or by the sponsors or representatives of the chairmen. In addition to the Metropolitan Section, the auxiliary has local Sections in the following cities: Boston, Chicago, Cleveland, Columbus, Los Angeles, Milwaukee, Philadelphia, Pittsburgh, Toledo, Washington, and membership of more than 900.

A report on the Calvin W. Rice Memorial Scholarship Fund was made by the chairman, Mrs. William E. Karg. Mrs. Karg gave us news of several of its beneficiaries. Mrs. F. H. Fowler, Jr., chairman, reported on the Student Loan Fund, and stated that five students had been granted loans during 1950.

Mrs. C. Higbie Young, treasurer, gave the following report, as of Sept. 30, 1950: Calvin W. Rice Memorial Scholarship Fund, $1782.66; Student Loan Fund ($6,000.00 of this Fund has been invested in U. S. Savings Bonds, Series G) $9689.28; General Fund, $1656.35.

The National Officers for the year 1951 were announced as follows:

President, Mrs. Frank W. Miller; 1st Vice-President, Mrs. Charles M. Hickox; 2nd Vice-President, Mrs. William E. Karg, 3rd Vice-President, Mrs. C. Harold Berry; 4th Vice-President, Mrs. Paul Gravelle; 5th Vice-President, Mrs. H. R. Kessler; Recording Secretary, Mrs. Robert W. Worley; Corresponding Secretary, Mrs. William L. Iliff; Treasurer, Mrs. C. Higbie Young; and Assistant Treasurer, Mrs. Charles Gladden.

James D. Cunningham, retiring president ASME, and J. Calvin Brown, incoming president, attended the meeting for a short period, each addressing the group.

The annual luncheon was a delightful event. This was served in the west ballroom of the Waldorf-Astoria Hotel. Some 200 ladies attended. A delicious luncheon was served. This was followed by a style show presented by Vanity Fair Mills. Mrs. U. A. Rothermel and Mrs. W. E. Case were chairmen.

Among the guests of honor were Mrs. James D. Cunningham, Mrs. James A. Vance, wife of the president of The Engineering Institute of Canada, Mrs. Richard E. Heartz, wife of the vice-president of The Engineering Institute of Canada, Mrs. O. V. S. Bulleid, wife of the consulting engineer for the Irish Railroads and past-president of The Institution of Mechanical Engineers, and Mrs. Batra from India.

On Thursday, Mrs. E. A. Lundstrom and Mrs. N. F. Dahl were chairmen for another delightful program. Mrs. Emily B. Hunter of F. Schumacher & Company, conducted us on a tour of the Williamsburg Rooms at the National Republican Club. Mrs. Hunter then gave a talk on "The Changing Scene in Decoration," showing many beautiful materials and wallpapers.

Following her talk, luncheon was served at the club.

Reported by MRS. CROSBY FIELD, chairman, Publicity.

ASME Standards Workshop

Screw Threads

THE results of the meeting of the working committee TC-1 on screw threads of the International Standards Organization held in Zurich, Switzerland, Sept. 25–27, 1950, were reported to the Standing Committee on Unified and American Screw Threads at a meeting in the Engineering Societies Building, New York, N. Y., Nov. 9, 1950.

I. H. Fullmer, senior physicist, National Bureau of Standards, Washington, D. C., who is chairman of the standing committee, and who served as U. S. delegate to the Zurich meeting, reported that the delegates in Zurich discussed the research being undertaken by the National Physical Laboratory of Great Britain on strength of screw threads in small-size fasteners with various thread angles.

Mr. Fullmer also discussed informally with British industry and military the question of extending American-British-Canadian unification of screw threads into the small sizes. British industry, he reported, was anxious to have unification expanded, but in one complete series only.

The subgroup on Unification of Numbered Sizes and Subcommittee No. 9 on Screw Thread Gages and Gaging also attended the Nov. 9 meeting. R. G. Cummings, of the subgroup on Unification of Numbered Sizes, expressed the opinion that a survey of screw-thread users in American industry would have to be made before any proposal could be made on unification in the smaller sizes. E. J. Bryant, chairman of the Sectional Committee, suggested that a survey of tap sales would give the best index of the relative usage of the various sizes and that the sale of dies would give similar information on manufacturers who make their own taps.

Machine-Tool Elements

Since May, 1950, sectional committee B-5 on Small Tools and Machine Tool Elements has issued the following six standards: Milling Cutters, ASA B5.3-1950; Twist Drills, ASA B5.12-1950; Involute Splines, ASA B5.15-1950; Single Point Tools, ASA B5.22-1950; Punch and Die Sets, ASA B5.25-1950; and Involute Serrations, ASA B5.26-1950. Technical Committee No. 24 has under consideration a new draft of the proposed American Standard for Inserted Blade Milling Cutters.

The proposed American Standard on Designation and Working Ranges of Surface Grinding Machines of the Reciprocating Table Type and Plain Cylindrical Grinding Machines was presented to the sponsors who are: The American Society of Mechanical Engineers, National Machine Tool Builders' Association, Metal Cutting Tool Institute, and Society of Automotive Engineers.

New Standards

In the near future sectional committee B16 on Standardization of Pipe Flanges and Fittings expects to release for publication the following two standards: (1) Proposed Revision of the American Standard for Steel Butt-Welding Fittings, ASA B16.9; (2) Proposed Revision of the American Standard for Malleable-Iron Screwed Fittings, 150 Lb, ASA B16.3.

Limits and Fits

Z. R. Bliss, Mem. ASME, professor of engineering, Brown University, Providence, R. I., was recently appointed chairman of Sectional Committee B4, Allowances and Tolerances for Cylindrical Parts and Limit Gages. Professor Bliss will reorganize the Committee and undertake a review of the 1947 edition of American Standard Limits and Fits for Engineering and Manufacturing.

Nuclear Energy

The Nuclear Energy Glossary Working Committee met in the Engineering Societies Building, Nov. 20, 1950, to review progress on a Comprehensive Glossary of Nuclear Terms used in engineering. The Working Committee is a subcommittee of the ASME Nuclear Energy Application Committee, which was organized in 1945 to explore how mechanical engineers could serve the nation in directing the new field of science into peacetime public service.

Because mechanical engineers were not familiar with nuclear energy terms, the Committee's first project was the compilation of a glossary of such terms in all fields of engineering of interest to mechanical engineers. The ASME soon discovered that some 20 other engineering societies were planning glossary projects. In 1948 the National Research Council, realizing that some kind of co-ordination was needed, called a conference to organize a joint effort by all groups working on nuclear glossaries. It soon became evident that many groups were active in limited or specialized fields only and that the committees of The American Society of Mechanical Engineers had already made considerable progress in the development of a plan for a comprehensive glossary. On invitation from the National Research Council, the ASME accepted general administrative responsibility for an over-all nuclear glossary project under NRC sponsorship.

According to the general plan, the glossary will consist of nine sections. Three of these: III, Reactor Engineering; V, Chemical Engineering; and VI, Biophysics and Radiobiology, have already been issued. Sections I, General Terms; II, Reactor Theory; IV, Chemistry; VII, Instrumentation; VIII, Isotopes Separation; and IX, Metallurgy, are still in the manuscript stage.

Junior Forum

Four Phases of Postgraduate Training Discussed at Junior Session

UNDER the sponsorship of the National Junior Committee a symposium was presented on "A Plan for the First Five Years After Graduation," during the 1950 Annual Meeting of The American Society of Mechanical Engineers. This symposium was largely based on a report of the same title prepared by the Committee on Professional Training of the Engineers' Council for Professional Development.

Community Relations

Karl B. McEachron, Jr., manager, technical education division, General Electric Company, Schenectady, N. Y., urged young engineers to recognize that they have obligations to their communities as well as to themselves and their families. Community relations are important because more time is spent in the community than on the job, and because growth of the local area depends upon the persons who are willing to aid in its advancement. By the very nature of democracy the community has a great amount of inertia and inefficiency, although this can be counteracted by activities of business and industry in community relations. There is need for more co-ordination of programs of existing groups rather than the establishment of new programs.

Registration

H. L. Solberg, head of School of Mechanical Engineering, Purdue University, Lafayette, Ind., gave information on the history and current status of engineering registration and told of some of the things that the young engineer might do as a part of his postcollege training. He cautioned that professional development does not stop with the attainment of legal registration. The attitude o employers toward engineering registration varies from complete indifference to a requirement that every man holding an engineering title must be registered. Undoubtedly there is room for educating industry on the legal requirements for engineering registration. The young engineer should consider whether lack of registration may discriminate against his further promotion and whether or not he may at some time hold a position that will require him to be registered. With the widening requirements for examinations he should also seek to get registered as soon as possible, rather than to wait until he has forgotten much about the engineering principles studied in college.

Part-Time Graduate Studies

J. C. McKeon, manager, University Relations, Westinghouse Electric Corporation, East Pittsburgh, Pa., pointed to the responsibility of the engineering profession to provide adequate educational opportunities for the employed engineer. This must be paralleled by professional growth on the part of the young engineer if he is to grasp fully the many technical opportunities open in both the technical and management fields. A self-development program is an important part of professional growth and should include informal as well as part-time formal education encompassing business and the humanities as well as technical subjects. Industry must not only encourage the development of their young engineers but must also work with the colleges and engineering societies in providing adequate educational opportunities.

Nontechnical Reading

"Nontechnical Reading" was the topic of a stimulating paper by W. B. Embler, head of the Department of Humanities, The Cooper Union, New York, N. Y., who examined the reasons for reading and found these: (1) because one feels compelled to read, (2) because it is the thing to do, (3) for entertainment, (4) for knowledge or information, and (5) to change one's mind by meeting an intellectual challenge. He suggested that an active reading pattern for the engineering graduate might begin by reading what one wants to read instead of what he thinks should be read.

This reading should be directed by making a simple list and it should then be supported with allied materials and researches. Next, the reader should talk about what he has read with a sympathetic friend, and finally, he should read with a purpose toward a definite end.

Reported by GLENN R. FRYLING
Member, National Junior Committee

Junior Committee Completes Third Year of Service

THE National Junior Committee held its 25th meeting in the Hotel Statler, New York, N. Y., Nov. 27, during the 1950 Annual Meeting. The Committee was organized in 1947, following the Annual Meeting in Atlantic City, N. J., to develop a program and services meeting the needs of younger engineers in the Society.

Those present were: Donald E. Jahncke, F. Everett Reed, Jr., G. B. Thom, B. H. Edelstein, W. P. Wier, Glenn R. Fryling, Harvey D. Moll, Henry Scagnelli, Miss Hope Wohnus, A. J. Snider, W. E. Bullock, Colin A. Roberts, O. W. Stephenson, Jr., and R. B. Green. Eugene W. O'Brien, past-president ASME, and F. D. Herbert, chairman of the Old Guard Committee, were also present for part of the meeting.

Mr. Fryling gave a progress report on the panel of 200 junior members under thirty years of age who are receiving letters explaining the work of the National Junior Committee. Three letters have already been mailed, Mr. Fryling said, and returns were beginning to come in. In general, juniors selected for the panel have reacted favorably to the letters and have submitted helpful suggestions.

Present Status to Continue

Mr. Jahncke reported that the National Junior Committee will serve for another year as a special committee reporting to Council, but that the Committee should consider asking Council for standing-committee status. It was the consensus that the Committee had only scratched the surface in its field of responsibility and that standing-committee status would give it more stability and assure financial backing for projects now under way.

Mr. Herbert was given a warm reception when he walked into the meeting. He said his purpose was to learn of the Committee's program for 1951 so that he could report to the Old Guard Committee and ask for financial support of its program. Mr. Herbert said he was highly pleased with the progress made

ASME Calendar of Coming Events

April 2–5
ASME Spring Meeting, the Atlanta Biltmore, Atlanta, Ga.
(Final date for submitting papers was Dec. 1, 1950)

April 16–18
ASME, Region VIII, Annual Meeting, Hotel President, Kansas City, Mo.

April 17–19
ASME Process Industries Division Conference, Lord Baltimore Hotel, Baltimore, Md.
(Final date for submitting papers was Dec. 1, 1950)

June 11–15
ASME Semi-Annual Meeting, Hotel Royal York, Toronto, Ont., Can.
(Final date for submitting papers was Jan. 1, 1951)

June 25–29
ASME Oil and Gas Power Division Conference, Baker Hotel, Dallas, Texas
(Final date for submitting papers was Jan. 1, 1951)

Sept. 10–14
ASME Industrial Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Houston, Texas
(Final date for submitting papers—May 1, 1951)

Sept. 24–26
ASME Petroleum Mechanical Engineering Conference, Hotel Mayo, Tulsa, Okla.
(Final date for submitting papers—May 1, 1951)

Sept. 25–28
ASME Fall Meeting, Hotel Radisson, Minneapolis, Minn.
(Final date for submitting papers—May 1, 1951)

Oct. 11–12
ASME Fuels and AIME Coal Divisions Joint Conference, Roanoke, Va.
(Final date for submitting papers—June 1, 1951)

Nov. 25–30
ASME Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.
(Final date for submitting papers—July 1, 1951)
(For Meetings of Other Societies see page 85)

during 1950 when the Committee held three conferences on the theme "How's Your P.D?" Section representatives who participated in the conferences in Washington, D. C., St. Louis, Mo., and Worcester, Mass., wrote him appreciative letters explaining how much they learned about the Society from their conference experience and how the Society's national meetings dramatized the ASME in action for them.

The meeting was concluded with a review of plans for the Junior Conference at the Spring Meeting at Atlanta and the Semi-Annual Meeting in Toronto. At Atlanta, where the Region IV Student branch conference will be held concurrently with the Spring Meeting, the Committee expressed interest in planning its conference as a feature of the Region IV student conference.

A. W. Schrage, on ASME Staff for 32 Years, Dies

A. W. SCHRAGE, a member of The American Society of Mechanical Engineers Staff for 32 years, died Nov. 23, 1950. He filled an important niche in the secretary's staff as business manager of the advertising section of MECHANICAL ENGINEERING. The nature of his job made him better known to people in the advertising field than it did to members of the ASME.

He was proficient in the many skills needed for producing the advertising section of a magazine.

His colleagues knew him as a tireless and patient worker. He rendered service beyond his duty cheerfully and without complaint. No questions addressed to him went unanswered and the little kindnesses of doing something for his friends and fellow workers appeared to give him the greatest satisfaction.

He was born in Brooklyn, N. Y., Aug. 2, 1888. He had supplemented his education at Pratt Institute with special courses at both Columbia and New York Universities. He was a Mason, being a member of Orient Chapter, Damascus Commandery, and Kismet, Temple. He is survived by his wife, Anna, a son, Robert W., and two brothers, William F. and Julius.

A. W. SCHRAGE

Engineering Societies Personnel Service, Inc.

These items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members or not, and is operated on a nonprofit basis. In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office. When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

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San Francisco
47 Post Street

MEN AVAILABLE[1]

PROJECT-PLANT ENGINEER, 33, BSME, U. of Wis. 1938; MSCE, Cal. Tech. 1947, member Tau Beta Pi, registered CE California. 12 years major oil company service construction and maintenance petroleum-processing, pipe-line, and refining equipment, also industrial and supporting facilities. Two years' foreign experience. Desires executive-level connection independent oil company or project-engineering position large engineering and construction contractor. West Coast desired, southern California preferred. Me-802.

POSITIONS AVAILABLE[1]

ASSISTANT CHIEF ENGINEER, preferably not over 40, considerable background in design. Should have initiative and creative ability to deal with problems on power transmission, i.e., gears clutches, etc. $7000–$8000. Pa. Y-4511.

MACHINE DESIGNER, 40–50, minimum five or six years' experience in design of special-purpose automatic machines. $6000–$7000. Upstate New York. Y-4514

DESIGNER, 30–40, mechanical graduate, at least seven years' experience on power boilers and pressure vessels, to design, lay out, make calculations, and supervise detailing of boilers and process equipment. $4000–$6000. Western Pa. Y-4516.

MANUFACTURING EXECUTIVE, 35–45, graduate, experience in mechanical engineering and manufacturing methods with emphasis on metal fabricating most desirable. Should have broad, practical knowledge of machines, dies, and tools, and proved record in plant management. Salary open. Ill. Y-4526.

ASSISTANT PLANT ENGINEER, 36–42, mechanical or electrical graduate, at least 10 years' experience covering general plant maintenance, power distribution, safety, plant protection, and industrial-plant operations for light-metal-products manufacturing using high-speed punch presses. $6000. Northern N. J. Y-4529.

MACHINE DESIGNER, 30–48, mechanical degree desirable, five years or more in design and perfection of automatic machinery in responsible position. Must be neat and rapid draftsman. Prefer man experienced with paper-converting machines, packaging machines, and special-purpose automatic machines for the development of new machinery and improvement of existing machinery. Salary open. Ohio. Y-4533.

MECHANICAL-DESIGN ENGINEER, graduate preferred, 10 to 15 years' experience on design of steam-electric stations covering preliminary and final layout of stations, heat-balance studies, design of pipe, preparation of inquiries and requisitions for purchase of equipment, ability to contact sales engineers, and supervision of draftsmen in preparation of drawings. New York, N. Y. Y-4538.

ASSISTANT PLANT MANAGER, 35–45, mechanical or electrical degree, two to five years in shop or toolroom; two to five years as line foreman and/or shop superintendent; five to 10 years methods engineering, tool design; two to five years as production-control supervisor and/or production manager. The above minimum of eleven years should have been spent in three or four shops of about 300 to 1000 employees. Salary open. Conn. Y-4551.

DESIGN ENGINEER, 35–40, mechanical graduate, at least 10 years' industrial power-plant experience, to design and lay out power-plant equipment and process-steam distribution for chemical manufacturer. $6000. N. J., Philadelphia area. Y-4561.

ASSISTANT TO VICE-PRESIDENT, 30–40, mechanical graduate, considerable executive experience, to co-ordinate all engineering for company manufacturing special machinery, blowers, compressors, etc. $7000–$8000. New York State. Y-4562.

MACHINE DESIGNER, minimum of 10 to 15 years' experience, to develop new operations, make studies, and head up group of machine designers and draftsmen. Particular experience in textile or packaging machinery or other high speed applications desirable. $6000–$8000. Some traveling. New York N. Y. Y-4589.

ENGINEERS. *(a)* Chief engineer considerable experience in the design and layout of sheet and rolling mills. $10,000–$12,000. *(b)* Draftsmen for work as above. Salary open. New York, N. Y. Y-4590.

TOOL SALES ENGINEERS. Must have some industrial sales experience and a thorough knowledge of tools and toolmaking. Opportunities in San Francisco, Chicago, Detroit, Cleveland, and Pittsburgh. $10,000–$12,000. Y-4591.

ENGINEERING DRAFTSMAN, mechanical graduate, 28–35, two to five years' plant-engineering experience, to lay out and detail steam-power plant, piping, mechanical-process equipment, heating, and ventilating etc. $4800–$6000. New York, N. Y. Y-4606.

INDUSTRIAL ENGINEER, graduate, at least five years' experience in steel mill or smelter, to take charge of work-simplification and incentive-methods program in heavy industry. $6000–$8000. Northern N. J. Y-4609.

MATERIALS ENGINEER, ME or BS graduate, experience covering metals, wood, plastics, coatings, etc., to supervise testing, specifications, and co-ordinate design and development regarding materials. $6000. Southern Conn. Y-4611.

VICE-PRESIDENT in charge of manufacturing for company engaged in manufacture of valves and fittings. Will take complete charge of a relatively large plant. $25,000. East. Y-4638.

DESIGNER, mechanical graduate, at least five years' machinery experience, to design processing equipment and mill machinery. $6500. New York, N. Y. Y-4643.

ENGINEERS. *(a)* Executive assistant to president, technical graduate, not over 40, 10 to 15 years' experience with progressively increasing responsibilities in plant management and control plus experience in sales activity. Will engage in production control, methods and costs, and sales for a manufacturer of bathtubs, lavoratories, and sinks. Knowledge of foundry operations and ceramics desirable. Over $8500. *(b)* Chief inspector, mechanical background, under 40, 10 to 15 years' responsible experience in visual inspection methods for manufacturer of the above products. Knowledge of ceramic finishes and foundry operations desirable. $6000–$7200. Ohio. R-7037.

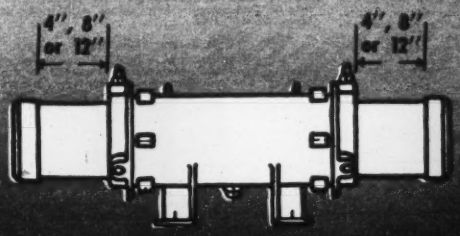
PROJECT ENGINEER, up to 35, mechanical or chemical engineering, two or more years' experience in injection plastics work. Knowledge of plastic injection or molding. Informed about building-material products. Design models, estimate costs, supervise quality control, and some new product research. $4200–$4800. Ohio. R-7044.

MANAGER OF INTERNATIONAL RESEARCH, industrial, mechanical, or chemical engineering with

(ASME News continued on page 94)

[1] All men listed hold some form of ASME membership.

YOU NEED FEWER JOINTS



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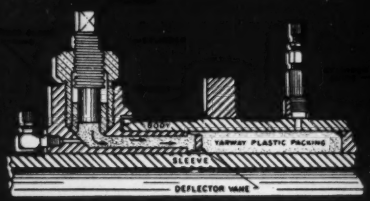
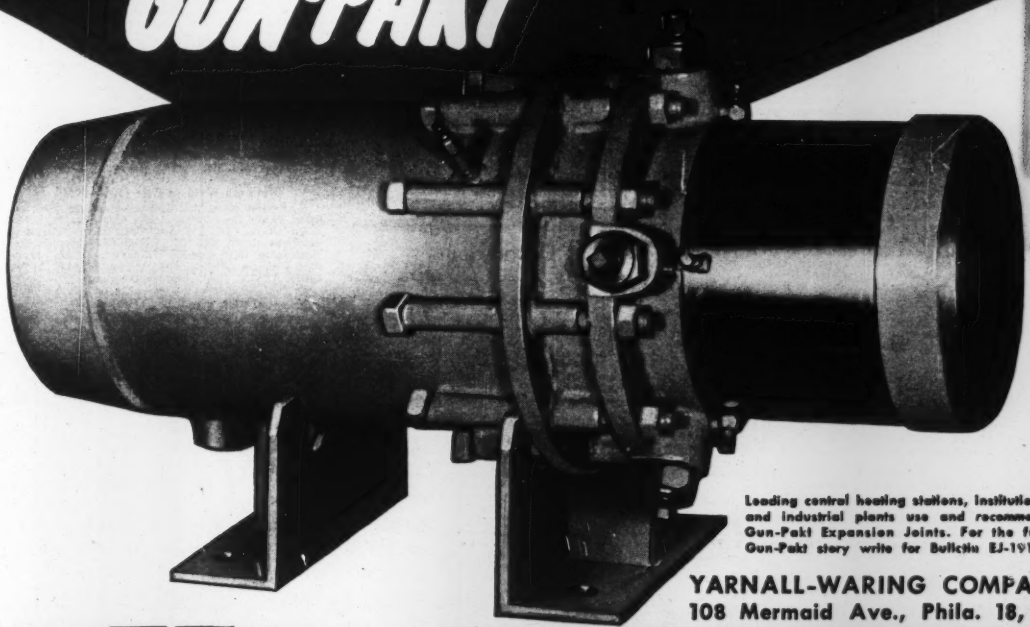


[illegible] need for shutdowns. Yarway [illegible] are serviced under full steam [illegible] a plug of Yarway plastic [illegible] and the job is done. Maintenance [illegible] manhours are [illegible]

W[illegible] GUN-PAKT [illegible]ints



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interest in foreign research problems and familiarity with U. S. policies regarding the technological program. Knowledge of research and development projects. Informed about business and economic fields. Will represent research organization in the expansion of internal projects for a research foundation. Salary open. Some foreign traveling. Ill. R-7146.

PROJECT ENGINEER, mechanical, over 30, six to seven years' experience in design and development of precision engine gears. Knowledge of gear transmission. Will design and develop precision engine gears for a manufacturer. Salary open. Ill. R-7147.

ASSISTANT PLANT ENGINEER, with four or five years' experience in plant engineering or maintenance in foundries or steel mills. Will assist in plant engineering and maintenance work in a steel foundry for a manufacturer. $4200–$5100. Northern Ind. R-7155.

Candidates for Membership and Transfer in the ASME

THE application of each of the candidates listed below is to be voted on after Jan. 25, 1951, provided no objection thereto is made before that date, and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the secretary of The American Society of Mechanical Engineers immediately.

KEY TO ABBREVIATIONS

R = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member.

NEW APPLICATIONS

For Member, Associate, or Junior

ALEX, FREDRIC R., Detroit, Mich.
ALEXANDER, FRANK B., Los Angeles, Calif.
AYLMER, ROBERT G., Chicago, Ill.
BABUNOVIC, MOMIR, St. Louis, Mo.
BANESS, LEONARD S., Middletown, Ohio
BARLOW, EDSON L., Pomfret, Conn.
BATCH, JOSEPH, Milwaukee, Wis.
BOGENRIEF, WILLIAM R., North Plainfield, N. J.
BOYAR, EDWARD E., Woodside, N. Y.
BRADY, JOHN F., Taunton, Mass.
BURCKHARDT, CARL E., Frankfurt am Main, Germany
BURKE, JOHN T., JR., Pittsburgh, Pa.
BURKE, ROBERT L., Easton, Pa.
CARLSON, EVERETT C., Buffalo, N. Y.
CHAPMAN, STUART H., Swarthmore, Pa.
CLARK, THOMAS, JR., Florham Park, N. J.
CLUTE, HENRY H., Los Angeles, Calif.
COLE, VERNON C., Waterbury, Conn.
COLOFF, PETE, Schenectady, N. Y.
CONROY, J. C., Boston, Mass.
CORBITT, WILLIAM S., Jr., Henderson, N. C.
CRONE, LESTER A., Summit, N. J.
CULLEN, JAMES T., Schenectady, N. Y.
DALL, ALBERT H., Cincinnati, Ohio (Rt&T)
DAZE, RICHARD E., Mount Vernon, N. Y.
DEDE, RICHARD P., Rockville Center, N. Y.
DENNIS, JOSEPH H., South Euclid, Ohio
DIENER, LAWRENCE L., Pittsburgh, Pa.
DINKINS, FIRM L., Pittsburgh, Pa.
DOCKRAY, GEORGE H., Washington, D. C.
DOUDA, HAROLD C., Shaker Heights, Ohio
DOWNS, BERNARD W., Chattanooga, Tenn.
DYMOND, DESMOND M., Toronto, Ont., Can.
ELLIOTT, WILLIAM J., San Francisco, Calif.
FRANTZ, SAMUEL G., Princeton, N. J. (Rt)
GENEVEY, L. P., Chevy Chase, Md.
GRAHAM, ARTHUR H., Trail, B. C., Can.
GRAHAM, JAMES G., New York, N. Y.
GREEN, WARING M., New Orleans, La.
GROBER, MAURICE W., Orange, N. J.
GUNNER, ALBERT M., Teddington, Middlesex, England
HICKEY, THOMAS L., Brockton, Mass.
HOGAN, WALTER H., Boston, Mass.
ISHIGAI, SEIKAN, East Lansing, Mich.
JANSEN, CARL B., Pittsburgh, Pa.
JOHNSON, CHARLES R., Glen Mills, Pa.
JOHNSON, MORRIS E., Monrovia, Calif.
KARRER, W., Zurich, Switzerland
KELLER, WILLIAM G., Hoboken, N. J.
KUSMIK, STEPHEN, Hartford, Conn.
LEGGETT, RICHARD H., Lawrence, Mass.
LEGIER, WILLIAM B., Poughkeepsie, N. Y.
LING, HOMER C., Larchmont, N. Y.
LOS CALZOS, DAVID A., Pittsburgh, Pa.
LOVE, RICHARD E., Great Neck, N. Y.
MACGREGOR, JOHN, Richland, Wash.
MACKIE, WILLIAM L., Oxnard, Calif.
MACLAUGHLIN, EARLE R., Midland, Mich.
MALIN, IAROBLAV I., New York, N. Y.
MAXFIELD, ALLEN F., Bergenfield, N. J.
MCDOWELL, E. L., Oak Park, Ill.
MCGARRITY, RICHARD V., Lansdowne, Pa.
MCMAHON, DAVID J., Milwaukee, Wis.
MELIDOSIAN, SAHAG C., Bronx, N. Y.
MOCHEL, NORMAN L., Ridley Park, Pa.
MURPHY, JAMES J., River Edge, N. J.
NARGAMVALA, JAMSHED P., Poona, India
PELLINO, AURELIO, Pelham Manor, N. Y.
PONTIOUS, ROBERT L., Park Forest, Chicago Heights, Ill.
POWELL, FRED K., JR., Valley Stream, N. Y.
POWERS, KENNETH P., Pittsburgh, Pa.
RALSTON, EDWARD L., Jr., Alliance, Ohio
RANDALL, GORDON E., Schenectady, N. Y.
RAYGOR, EDWIN D., Erie, Pa.
REILLY, THOMAS J., Milwaukee, Wis.
REITER, RICHARD E., Lincoln Park, Mich.
RICE, PHILIP K., White Plains, N. Y.
ROTHWELL, MICHAEL O., Seattle, Wash.
SALEHAR, RAYMOND J., Cleveland, Ohio
SAMARAS, D., Dayton, Ohio
SCHEPER, GEORGE W., Jr., Schenectady, N. Y.
SCHMACHTENBERG, EVERETT C., Short Hills, N. J. (Rt&T)
SCHROTH, JOHN J., Philadelphia, Pa.
SCHWARTZ, HERBERT, Forest Hills, N. Y.
SHAW, E. E., Los Alamos, N. Mex.
SLAYTON, CLARENCE H., JR., Lenox, Mass. (Rt&T)
SMITH, SPENCER G., New York, N. Y. (Rt)
SOLAWETZ, DONALD J., Riverside, Ill.
SPOONER, MIKE E., San Francisco, Calif.
STANDING, BASIL, Manchester, England
STEINER, ROBERT O. C., Milwaukee, Wis.
WASHBURN, W. D., Hopewell, Va.
WCISLO, CHESTER R., Hampton, Va.
WHITELAW, ROBERT L., Alliance, Ohio
WILLIAMS, JESSE L., Baltimore, Md.

CHANGE IN GRADING

Transfers to Member and Associate

APT, JEROME, JR., Pittsburgh, Pa.
BENNETT, ARTHUR L., St. Louis, Mo.
BOKORNEY, FRED R., Chicago, Ill.
CARREAU, GERALD, New York, N. Y.
DARNELL, CARL W., Indianapolis, Ind.
DASELM, C. HILTON, Albuquerque, N. Mex.
FORBES, BERNARD W., Brooklyn, N. Y.
FORFAR, D. M., Minneapolis, Minn.
GREENBERG, JOSEPH H., Chicago, Ill.
GREFFE, C. DALE, Urbana, Ill.
HOLLISTER, EZRA, Kennewick, Wash.
JASPER, NORMAN HANS, Washington, D. C.
JONES, DAVID E., Jr., Ridgewood, N. J.
KENDRICK, JOHN W., Chicago, Ill.
LINGNER, G. L., Tenafly, N. J.
MANSFIELD, WILLIAM M., McGill, Nev.
PARSONS, LEONARD D., Jr., Monroe, La.
REESE, EDWIN W., Jr., Cincinnati, Ohio
ROBINSON, WALTER, Columbus, Ohio
ROUDEBUSH, SAM I., Bogota, Colombia, S. A.
SIMRONE, VINCENT A., Medford, Mass.
STEVENSON, JOHN M., Grapevine, Texas
SWENSON, JOHN D., Amherst, Mass.
UNTERMEYER, SAMUEL, 2nd, Chicago, Ill.
VITALE, JOSEPH A., Lexington, Mass.
WIBERG, DONALD V., Minneapolis, Minn.

Transfers from Student Member to Junior... 75

Obituaries

Donald Parsons Allen (1906–1950)

DONALD P. ALLEN, chief engineer, Rensselaer Valve Co., Troy, N. Y., died Feb. 4, 1950. Born Lawrence, Mass., June 12, 1906. Parents, Samuel Earle and Anna (Parsons) Allen. Education, BSCE, University of Illinois, 1932. Jun. ASME, 1940; Mem. ASME, 1943. Survived by parents.

Henry Asa Allen (1867–1950)

HENRY A. ALLEN, mechanical engineer in charge for the City of Chicago, Ill., died Aug. 18, 1950. Born, Madison, Wis., Jan. 22, 1867. Parents, Thomas S. and Natalia (Weber) Allen. Education, graduate, U. S. Naval Academy, 1887. Married Florence Pennington, 1927. Held patents on mining, pumping, and power machinery. Designed the pumps and tunnels at the Chicago (Ill.) Ave. Station; high-lift irrigation plants, Hawaiian Islands; hydraulic-mining plants, Alaska; compressed-air hoisting and mine drainage systems for mines in the U. S., Mexico, Australia, Africa, and China. He was one of the consultants on the Panama Canal appointed by Pres. Theodore Roosevelt in 1907. Mem. ASME, 1900. Survived by wife.

Horace Bricknell Barnes (1889–1950)

HORACE B. BARNES, supervisor, mechanical drafting, Philadelphia Electric Co., Philadelphia, Pa., died Oct. 11, 1950. Born, Philadelphia, Pa., Oct. 6, 1889. Education, attended Drexel Institute of Technology. Assoc-Mem. ASME, 1922; Mem. ASME, 1935.

Knute Berger (1890–1949?)

KNUTE BERGER, whose death occurred sometime in 1949 and was recently reported to the Society, was president, general manager, Berger Engineering Works, Inc., Seattle, Wash. Born, Oksningen, Norway, March 2, 1890. Education, ME, Christiania Technical School, 1910. Naturalized U. S. citizen. Mem. ASME, 1926.

John Randolph Brittain (1872–1950)

JOHN R. BRITTAIN, mechanical engineer, Los Angeles Railway Corp., Los Angeles, Calif., died July 10, 1950. Born, Vineland, N. J., June 13, 1872. Education, State Normal School, Bloomsburg, Pa.; Massachusetts Institute of Technology. Mem. ASME, 1922.

Hugh Scott Cameron (1904–1950)

HUGH SCOTT CAMERON, associate professor, mechanical engineering, dean of students, Rice Institute, died at Methodist Hospital, Houston, Texas, June 21, 1950. Born, New York, N. Y., Nov. 25, 1904. Parents, Frederick K. and Annie M. H. (Blauvelt) Cameron. Education, ME, Stevens Institute of Technology, 1925. Married Laura H. June, 1931. Jun. ASME, 1925; Mem. ASME, 1943. Survived by wife and two children, Elaine S. and Hugh S., Jr.

Willis Haviland Carrier (1876–1950)

WILLIS H. CARRIER, a pioneer in air conditioning, chairman emeritus of the Carrier Corp., Syracuse, N. Y., died Oct. 7, 1950 in the Cornell Medical Center of the New York (N. Y.) Hospital. Born, Angola, N. Y., Nov. 26, 1876. Parents, Duane Williams and Elizabeth (Haviland) Carrier. Education, ME, Cornell University, 1901; honorary degrees, DE, Lehigh University, 1935; DS, Alfred University, 1942. Married Edith Claire Seymour, 1902 (died 1912). Married 2nd, Jennie Tifft Martin, 1913 (died 1939). Married 3rd, Elizabeth Marsh Wise, 1941. Assoc. ASME, 1905; Mem. ASME, 1912; Hon. Mem. ASME, 1942. ASME Medalist, 1934. Awarded the John Scott, F. Paul Anderson, and Frank P. Brown Medals for his achievements in heating and ventilating, refrigeration, and air conditioning. He was named a "Modern Pioneer of Industry" by the National Association of Manufacturers. Author of many papers in his field of engineering and held several patents on his inventions. He was an officer or honorary member of many technical societies here and abroad.

George Sessions Case (1882–1950)

GEORGE S. CASE, chairman, executive committee, The Lamson and Sessions Co., Cleveland, Ohio, died Oct. 11, 1950, at the Lakeside Hospital, Cleveland. Born, Interlaken, N. Y., Oct. 16, 1882. Parents, Frank Castle and Fannie (Sessions) Case. Education, BS, Case School of Applied Science, 1904; ME, 1927. Married Amey Ellen Hall, 1906. Mem. ASME, 1917. Survived by wife, son, George S., Jr., Cleveland; and daughter, Mrs. Barbara C. Franklin, Cleveland.

Kenneth Watkins Cole (1900–1950)

KENNETH W. COLE, district manager, Pressed Steel Tanks Co., Chicago, Ill., died Oct. 24, 1950. Born, Avon, N. Y., Aug. 20, 1900. Parents, Winfield Scott and H. Janet (Watkins) Cole. Education, ME, Cornell University, 1922. Married Virginia Whyte, 1945. Jun. ASME, 1924; Mem. ASME, 1935. Survived by wife.

Harold Rex Davis (1910–1950)

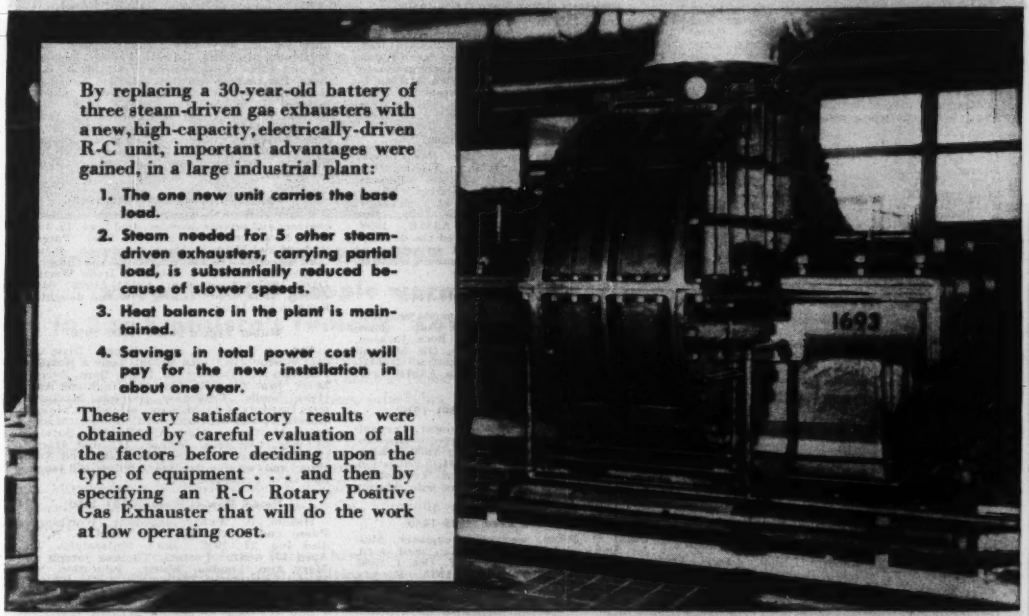
HAROLD R. DAVIS, senior cost accountant, Bendix Aircraft Corp., Teterboro, N. J., died Oct. 28, 1950. Born, Chicago, Ill., July 21, 1910. Parents, Louis R. and Ida M. (Brandriff) Davis. Education, BSME, Armour Institute of Technology, 1932; MBA, Harvard University Graduate School of Business Administration, 1934. Married Caroline Fullerton, 1934. Jun. ASME, 1932. Survived by wife and three daughters, Jocelyn, Barbara, and Deborah.

Robert Ernest Doherty (1885–1950)

ROBERT E. DOHERTY, president emeritus, Carnegie Institute of Technology, died in Scotia, N. Y., Oct. 19, 1950. Born, Clay City, Ill., Jan. 22, 1885. Parents, Anthony and Clara (Sauther) Doherty. Education, BS University of Illinois, 1909; MS, Union College, Schenectady, N. Y., 1921; hon. MA, Yale University, 1931; hon. LLD, Tufts College and University of Pittsburgh, 1936. Married Pearl Edna Mills, 1911. Awarded Lammé Medal for engineering, AIEE,

(*ASME News continued on page 96*)

NEW R·C EXHAUSTER *pays its own way*



By replacing a 30-year-old battery of three steam-driven gas exhausters with a new, high-capacity, electrically-driven R-C unit, important advantages were gained, in a large industrial plant:

1. **The one new unit carries the base load.**
2. **Steam needed for 5 other steam-driven exhausters, carrying partial load, is substantially reduced because of slower speeds.**
3. **Heat balance in the plant is maintained.**
4. **Savings in total power cost will pay for the new installation in about one year.**

These very satisfactory results were obtained by careful evaluation of all the factors before deciding upon the type of equipment . . . and then by specifying an R-C Rotary Positive Gas Exhauster that will do the work at low operating cost.

Even though your equipment to handle gas or air may still have years of life, it may be sound economy to replace it with modern, efficient, R-C units of the right type, size and drives to best meet your needs. Our engineers will help you analyze your problem and make unbiased recommendations of either Rotary Positive or Centrifugal equipment, depending upon your specific conditions. This *dual choice* is an exclusive R-C advantage.

With capacities from 5 cfm to 100,000 cfm, R-C units can be closely matched to work requirements, for dependable, economical performance. At Roots-Connersville, almost a century of blower building experience is at your service, without obligation.

ROOTS-CONNERSVILLE BLOWER CORPORATION
151 Michigan Avenue, Connersville, Indiana

Type RCGH Rotary Positive Gas Exhauster, driven by 450-hp synchronous motor. Capacity, 20,600 cfm.

Single-stage, Type OIB Centrifugal Blower in food processing plant. Steam turbine drive; capacity 12,000 cfm.

ROOTS-CONNERSVILLE
BLOWER BUILDERS SINCE 1854
ONE OF THE DRESSER INDUSTRIES

1937; for education, SPEE, 1945. First prize for self-portrait in oil, Association of Artists of Pittsburgh (Pa.), 1944. Fellow ASME, 1941. He was credited with having played a prominent part in developing the high-tension electrical system that is now nationwide. Coauthor, "Mathematics of Modern Engineering." Author of several other books. Contributed technical articles to many journals. During World War II he was active in advisory work for the government. Survived by wife, two sons, Robert E., Jr., Wichita Falls, Texas; James A., Tulsa, Okla., a daughter, Vera Maud; and three brothers and three sisters.

Frederick Charles Freeman (1882–1950)

FREDERICK C. FREEMAN, chairman, board of directors, Providence (R. I.) Gas Company, died Nov. 6, 1950, in Rhode Island Hospital. Born, Jersey City, N. J., Sept. 5, 1882. Parents, Henry and Mary Freeman. Education, M.E., Stevens Institute of Technology, 1903. Married Marion Cowie. Jun. ASME, 1911; Mem. ASME, 1916. Survived by wife.

Walter Lojo Greenwall (1863–1950)

WALTER L. GREENWALL, retired junior designer, general engineering department, Nordberg Manufacturing Co., Milwaukee, Wis., died in January, 1950. Born, Finland, Feb. 20, 1863. Parents, Otto A. and Olivia K. Grönvall. Education, attended University of Helsingfors, Finland. Naturalized U. S. citizen, Milwaukee, Wis., Sept. 21, 1893. Married Hildur C. Hille, 1901. Mem. ASME, 1911.

William Parker Hawley (1869–1950)

WILLIAM P. HAWLEY, whose death was recently reported to the Society, was retired, professor emeritus of mechanical engineering, Lewis Institute, Chicago, Ill. Born, Burr Oak, Mich., Sept. 21, 1869. Parents, John Henry and Amy (Parker) Hawley. Education, BS, Michigan State College, 1892. Married Mary T. Thomas, 1901. Jun. ASME, 1903; Assoc. ASME, 1910.

Ray Alfred Hinkley (1887–1950)

RAY A. HINKLEY, design engineer, Corning Glass Works, Corning, N. Y., died Feb. 24, 1950. Born, East Canton, Pa., Jan. 20, 1887. Parents, Hiram and Effie Hinkley. Education, attended Massachusetts Institute of Technology. Married Reva Richards, 1948. Mem. ASME, 1944. Held several U. S. patents. Survived by wife, brother, Floyd; and sister, Viola.

Joseph Alfred Horne (1869–1950)

JOSEPH A. HORNE, chairman of the board of directors, Yale and Towne Manufacturing Co., Stamford, Conn., died Oct. 3, 1950. Born, Birmingham, England, March 16, 1869. Parents, James and Ann (Holland) Horne. Education, New Britain (Conn.) High School; attended Columbia University. Married Margaret A. Burke, 1892. Mem. ASME, 1913. Survived by wife and a sister, Mrs. William L. Joy.

Walter Fortnum Jones (1891–1950)

WALTER FORTNUM JONES, retired engineer, died at Waterbury (Conn.) Hospital, Oct. 8, 1950. Born, Delanco, N. J., April 23, 1891. Parents, Franklin P., Sr., and Jemima (Fortnum) Jones. Education, BSME, University of Pennsylvania, 1913. Married Adele B. Codding, 1923. Assoc-Mem. ASME, 1920; Mem. ASME, 1935. Survived by wife.

Douglas Leighon Keys (1888–1950)

DOUGLAS L. KEYS, mechanical engineer, charge of marine sales, Texas Co., Norfolk, Va., died Sept. 4, 1950. Born, Boulder Creek, Calif., Oct. 11, 1888. Parents, Peter Jason and Sarah Emma (Aburr) Keys. Education, high-school graduate; Humbolt Evening School. Married Marion C. Philbrick, 1911; children, Constance Nadine, Natalie Olive, Douglas L., Jr. Assoc-Mem. ASME, 1919; Mem. ASME, 1925.

Garland Lufkin (1896–1950)

GARLAND LUFKIN, vice-president, Owen-Illinois Glass Co., died Oct. 23, 1950, in Toledo, Ohio. Born, Salem, Mass., Sept. 5, 1896. Parents, Olvin H. and Cora A. (Ballard) Lufkin. Education, BS, Massachusetts Institute of Technology, 1920. Married Roma H. Reilly, 1926. Jun. ASME, 1923; Assoc-Mem. ASME, 1926; Mem. ASME, 1929. He pioneered the development of fiber glass. Survived by wife and daughter, Mrs. Hampton Kirchmaier, Detroit, Mich.; his mother and two sisters.

Robert Maxwell Olsen (1919–1949)

ROBERT M. OLSEN, mechanical engineer, Commonwealth and Southern Corp., Jackson, Mich., died Sept. 24, 1949. Born, Jackson, Mich., May 28, 1919. Parents, Ole Maxwell and Leota Pearl Olsen. Education, BSME, University of Michigan, 1946. Jun. ASME, 1947. Survived by parents.

Ralph Warwick Pressey (1891–1950)

RALPH W. PRESSSEY, chief engineer, Pennsylvania Hospital for Mental and Nervous Diseases, Philadelphia, Pa., died Sept. 2, 1950. Born, Haddonfield, N. J., Feb. 8, 1891. Education, graduate of Drexel Institute of Technology. Mem. ASME, 1940. Survived by wife, Marion Pressey.

James Hodnett Reed (1925–1950)

JAMES H. REED, mechanical engineer, Alexander Smith and Sons Carpet Co., died in St. Joseph's Hospital, Yonkers, N. Y., Oct. 1, 1950. Born, Brooklyn, N. Y., Jan. 9, 1925. Parents, Robert Edward and Mary Agnes (Donovan) Reed. Education, BME, New York University, 1947. Jun. ASME, 1947. Survived by parents.

Francis Becht Rein (1907–1950)

FRANCIS BECHT REIN, plant superintendent Commercial Solvents Corp., Terre Haute, Ind., died June 9, 1950. Born, Washington, Ill., Feb. 5, 1907. Parents, George Martin and Elizabeth (Becht) Rein. Education, high-school graduate; ICS; special courses, Rose Polytechnic Institute. Married Mildred Emory, 1930. Mem. ASME, 1945. Survived by wife.

Stewart Fisher Robertson (1905–1950)

STEWART F. ROBERTSON, partner, charge of mechanical engineering, Whitman, Requardt and Associates, Baltimore, Md., died in Chambersburg, Pa., of a heart attack, Oct. 23, 1950. Born, Baltimore, Md., Aug. 7, 1905. Parents, Frederick W. and Edna A. Robertson. Education, Baltimore Polytechnic Institute, 1923; The Johns Hopkins University Evening School. Married Mildred C. Schulz. Jun. ASME, 1938; Mem. ASME, 1940. Served as chairman, Baltimore Section, ASME, 1948–1949. Currently he had been serving as chairman of the group preparing the mechanical section of the proposed State of Maryland Building Code. Survived by wife and his mother.

Robert R. Sanderson (1889–1950)

ROBERT R. SANDERSON, retired mechanical engineer and private investor, died Sept. 22, 1950. Born, New York, N. Y., Sept. 12, 1889. Parents, Richard and Mildred (Hays) Sanderson. Education, attended Cornell University and Brooklyn Polytechnic Institute. Married Irene Werther, DDS, 1935. Assoc-Mem. ASME, 1922; Mem. ASME, 1935. Survived by wife and daughters, Roberta and Irene.

Wilbur Tagard Soulis (1890–1950)

WILBUR T. SOULIS, chief engineer, Dixie Cup Co., Easton, Pa., died at St. Luke's Hospital, Fountain Hill, Pa., Oct. 10, 1950. Born, Everett, Mass., June 29, 1890. Parents, Hugh and Annie (Prue) Soulis. Education, graduate, Massachusetts Institute of Technology; attended Columbia University and University of Colorado. Married Sylvia Matthews. Mem. ASME, 1925. Survived by wife, two sons, Wilbur, Jr., and Harold; three daughters, Lenore, Jean Mary, and Annie Prue; and two step-daughters, Sylvia and Jacqueline, all of Bethlehem, Pa.

Heidel Howett Wentz (1881–1950)

HEIDEL H. WENTZ, expeditor, Worthington Pump and Machinery Corp., Buffalo, N. Y., died Jan. 27, 1950. Born, Philadelphia, Pa., April 13, 1881. Parents, Thomas Joseph and Mary Ann (Louden) Wentz. Education, ME, Drexel Institute of Technology, 1901. Married Mary Gardner Cannon. Mem. ASME, 1926. Survived by wife.

Christian A. Wills (1879–1949)

CHRISTIAN A. WILLS, vice-president, general manager, William B. Pollock Co., Youngstown, Ohio, died Oct. 10, 1949. Born, Warren, Pa., July 29, 1879. Parents, Henry and Jeannette (Retterer) Wills. Education, high-school graduate; ICS. Married Ella Sersall, 1906 (died 1940). Mem. ASME, 1931. Survived by son, Richard B., Youngstown, Ohio; and daughter, Mary E. Wick, Chicago, Ill.

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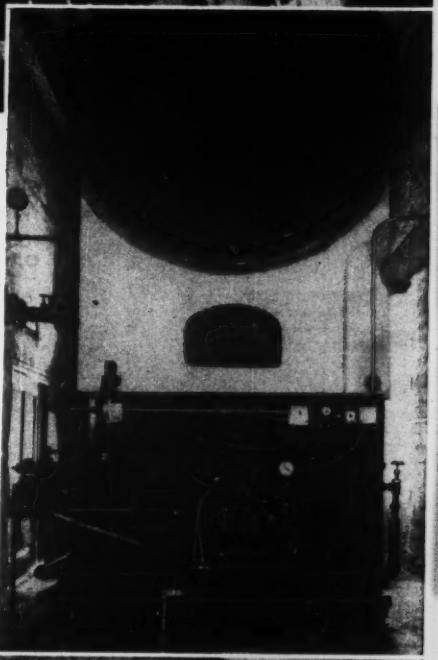
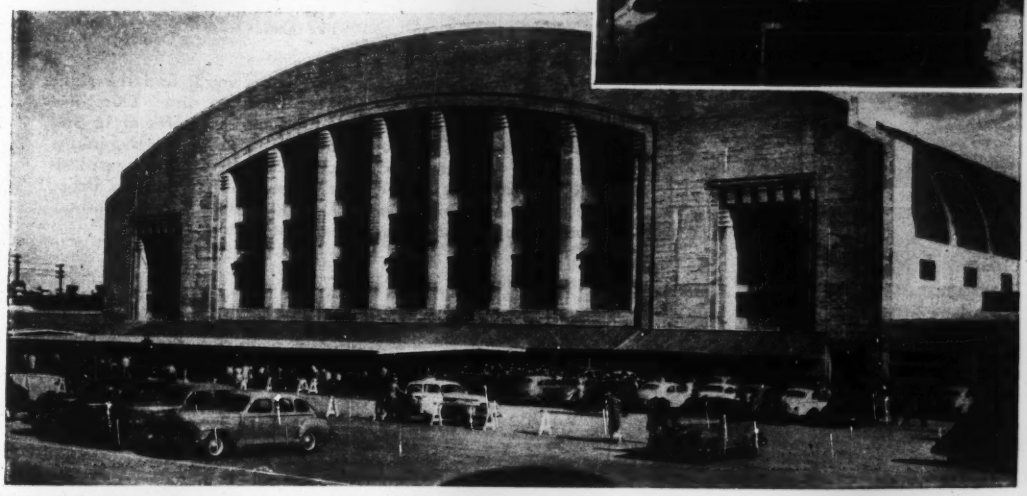


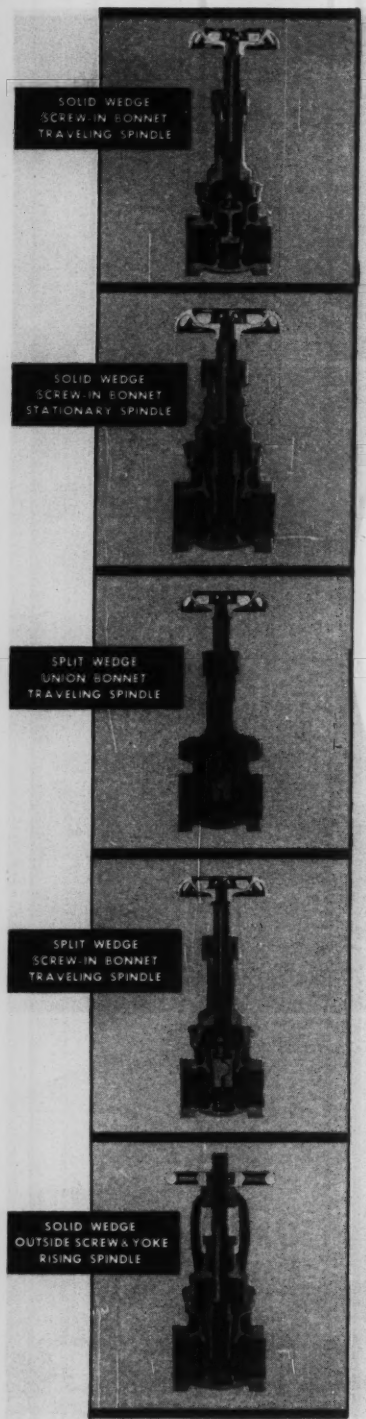
A single JOHNSON OIL BURNER keeps 19,600 people warm in San Francisco's famous "Cow Palace"

Heating a vast indoor arena like San Francisco's amazing "Cow Palace" is a man-size job. Under its wide arching roof, as many as 19,600 spectators can be seated to watch rodeos, horse shows, circuses, prizefights, basketball games and Grand National Livestock Expositions.

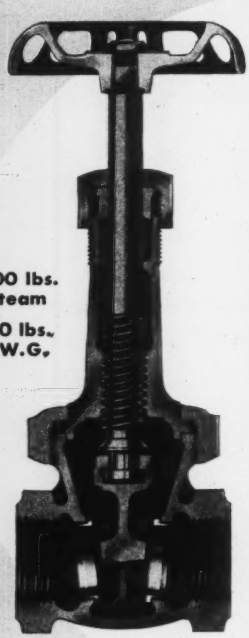
A single Johnson Burner is doing the job. It is an automatic 400 HP Johnson Rotary Oil & Gas Burner which can be operated on either heavy fuel oil or gas. Mounted in a Birchfield Boiler, it supplies hot water to fan-driven space heaters. Installation was made by Crowley Co., Plumbing and Heating Contractors of San Francisco.

For nearly half a century Johnson Burners have been heating great buildings all over the world. You'll find them supplying dependable low-cost heat in thousands of schools, hotels, hospitals, churches and skyscrapers . . . and in countless private homes as well. If you have a heating problem, see your nearby Johnson Dealer or write to S. T. Johnson Co., 940 Arlington Ave., Oakland 8, Calif. or 401 No. Broad St., Philadelphia 8, Pa.





Specify JENKINS for your Best Buy in Bronze Gates



JENKINS FIG. 270-U
Solid Bronze Wedge
and FIG. 270-UN
Nickel Alloy Wedge
Traveling Spindle — Union Bonnet
BRONZE GATES

Monel and Bronze Seating Combination Adds Years of Extra Service Life

In Fig. 270-U, a high quality bronze wedge seats against MONEL rings expanded in the body. With this sensible design, the wear affects only the most accessible part—the bronze wedge—which can be easily replaced by slipping a new one on the stem when necessary. Records in every type of service prove it an excellent combination for lasting economy.

Fig. 270-UN, with a nickel alloy wedge, is recommended for exceptionally severe conditions of rapid wear and corrosion.

The Gates For Your Toughest Services

Made in sizes from ¼" to 2", Fig. 270-U or Fig. 270-UN will provide unequalled economy in any 200 lb. steam, 400 lb. O.W.G. service. Compare performance, especially where conditions are most destructive to valves, as in oil refineries, dye houses, chemical, rubber, and food plants. You'll find there are no other valves like them.

Whatever your need in Bronze Gates, you'll find the right valve for the service in Jenkins complete line. Thirty-five different patterns are available for steam pressures up to 300 lbs., O.W.G. pressures up to 600 lbs. All are built to Jenkins unvarying high standard which makes them the longest-lasting, lowest-upkeep valves that money can buy. Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors.

WRITE FOR THIS FOLDER Form 181-B It describes the Fig. 270-U and other popular Jenkins Bronze Gates or, ask your Jenkins Distributor.

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• NEW EQUIPMENT

New Leeds & Northrup Electric Control Features Rate Action, High Sensitivity

A new control system just announced by Leeds & Northrup Co.—P.A.T. '50—for the first time introduces rate action into an electrically-actuated control. The significance of rate action is that it responds according to the speed with which the controlled variable changes—and thus improves process output by reducing the length of time that an upset can force the controlled process off its set point.

If furnace temperature, for example, begins to fall, rate action immediately opens the fuel valve. The faster the drop in temperature, the wider the valve is opened. And as the rate of temperature departure decreases, rate action's effect also decreases—"putting on the brakes" to bring temperature smoothly back in line.

Like the previous L&N model, P.A.T. '50 also has proportional and reset control actions, and is applicable to the regulation of temperature, pH, chemical concentration and gas analysis. The key element of the control system is a new Control Unit, which electrically links a Micromax or Speedomax recording instrument and an L&N Electric Valve Drive mechanism. Existing P.A.T. installations can have the full benefit of P.A.T. '50 performance by converting to the new Control Unit.

Offering even greater sensitivity than its predecessor, the new P.A.T. '50 Control Unit has no moving parts; control action is accomplished by electronic circuits. Valve position can be measured remotely at the control panel without interfering with control action. Major electronic components are plug-in types, easily replaced. The entire control chassis comes out as a unit for inspection.

For further details, write to Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia 44, Pa.

Engine Production Record

Topping a long-standing record of producing more horsepower than any other manufacturer in the air-cooled engine field was achieved recently by Wisconsin Motor Corp., Milwaukee, Wis., with the building of Wisconsin Heavy-Duty Air-Cooled Engine No. 1,500,000, according to the manufacturer.

This engine represented the completion of delivery of over 18,000,000 hp. which is more than 12 times the power generated by Niagara Falls.

According to executives, builders in every field are more and more considering Wisconsin-Power as "Standard-Power, 3 to 30 hp." Wisconsin Engines are extensively used as power components on a great variety of original equipment, and it is reported that current production has been greatly stepped up to meet the accelerated demand for Wisconsin Engines. New monthly records are now being established.

Hyster Announces New Logging Arch

For heavy-duty logging, particularly in Redwood, heavy pine and fir areas, the Hyster Company announces a new logging arch, the Model "80," for use with "Caterpillar" D8 track-type tractors.

Manufactured at the company's Portland, Oregon factory, the Model 80 is the largest of the Hyster line and is the second improved logging arch to be placed on the market by the manufacturer within the past two months. Like the model 78, announced in August, the new arch is considerably less in weight than older models but retains the rugged construction and balanced characteristics of previous designs. Reduced weight permits greater speed over steeper terrain and increased production.

An important feature of the Model 80 is that its boom tip fairlead rolls and lower guide sheave are made of manganese steel developed to give extreme abrasion resistance and long life.

In addition, an increase of approximately one foot in roll height to the top of the main roll permits bigger payloads per trip.

Maximum stability, maneuverability and visibility are given the arch by its basic A-Frame type of design and box-type structural members.

For additional details a specification sheet will be furnished upon request from the Hyster Co., Portland 8, Oregon.

Pump Casing of Nodular Iron Cast at Farrel-Birmingham

Some foundries licensed to make nodular iron have gone beyond development of their practice with small work and a number of heavier castings of this relatively new ductile metal are now being commercially produced.

An example is the pump case illustrated, which is one of several cast at the Farrel-Birmingham foundry, Derby, Conn., where excellent control has been established in combination with facilities especially suited to larger work.

DeLaval Steam Turbine Co., Trenton, New Jersey, has initiated the use of nodular iron for pump casings of this type, and the company has reported entirely satisfactory hydrostatic tests on these units, which show slight deflection at 750 p.s.i. and no leakage at 1500 p.s.i.

The case and cover illustrated have a combined weight of 8,314 lbs., and the substitution of nodular iron for steel in a unit of this size represents an appreciable saving in cost.

With increased experience and greater reliability of casting practice, there should be no size limitation of nodular castings and more significant economy in single units is anticipated where ductile iron can be properly substituted for steel.

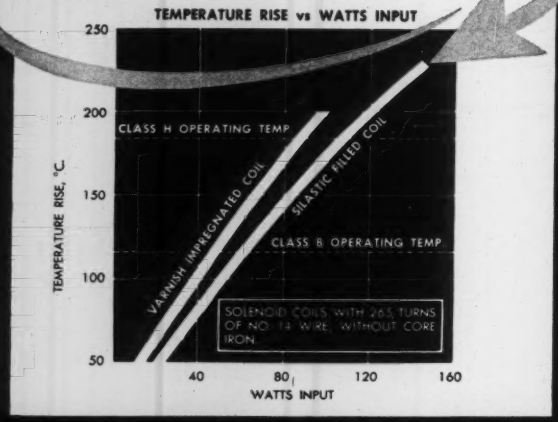
The crux of the casting process, which requires the most meticulous control, is the introduction of the small but effective amount of magnesium which converts the graphite to spheroidal form.

Niagara Blower New High Capacity Condenser

This new high capacity Aeropass Condenser is built to serve large refrigeration plants. Its nominal rating is 300 tons, and in field tests approximately 350 tons capacity is reported. In principle it is like the smaller units of Niagara Blower Co. manufacture, making use of the company's patented "Duo-Pass" pre-cooling coil and "Oilout" oil separator.

Continued on Page 44

SILASTIC* the resilient dielectric, stable from -60° to +200°C.



dissipates heat much faster than conventional insulating materials

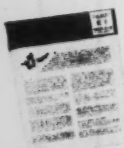
Here's an insulating material that gives you all of the advantages of a rubberlike dielectric at *Class H temperatures*, plus extreme low temperature flexibility, plus about twice the thermal conductivity of conventional resinous or rubbery dielectrics! In a solenoid coil, for example (see graph above), Silastic gives 15% more capacity than resinous silicone insulation at 180°C. That's due to increased thermal conductivity alone.

Thermal stability plus high heat conductivity permit the Silastic coil to operate at 166% of the maximum capacity for an identical organic resin impregnated solenoid. Performance of over 1600 Silastic insulated main and interpole field coils in diesel-electric traction motors is further proof of the extraordinary advantages of Silastic as a dielectric.

In coils of all kinds, Silastic provides resiliency and relatively constant dielectric properties at temperatures ranging from below −60° to above 200°C., maximum resistance to corona, to electrical and mechanical fatigue and to abrasion, oil and outdoor weathering.

(*T. M. Reg. U. S. Pat. Off.)

Silastic insulated solenoid has 166% of the capacity of identical Class B coil plus maximum shock, abrasion and vibration resistance over a span of 260 Centrigrade degrees from —60 to +200°C.



SEND TODAY! **For your copy of Silastic Facts No. 10 containing data on the properties, performance and applications for Silastic.**

from +500°F. SILASTIC stays Elastic to −100°F.

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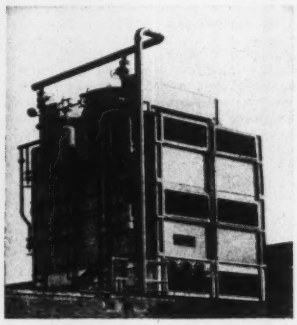
• Keep Informed

The refrigerant gas first passes thru the pre-cooling coils which are located on top of the structure. These coils remove the superheat and reduce gas temperature close to its condensing point. This coil also condenses entrained oil vapors, thus providing an ideal point for easily removing oil from the system by the "Oilout" separator drums which are next in line. The gas then passes to the condensing coils where it is condensed by the effect of evaporation of a strong water spray. By the evaporative principle approximately 1000 Btu are removed from each pound of water evaporated and condensing is most efficient, and at low temperature. Since the superheat has been previously removed there is no tendency for salts to precipitate and clog the condenser coil banks. As only the water evaporated is consumed very large water savings are made as compared to conventional condensing methods. Also, great savings are obtained in the use of space and in piping, pumping and operating horsepower.



Air is drawn thru the condenser by a large propeller fan. It enters thru screened ports arranged so that the correct proportion of the air stream passes thru the two pre-cooling "Duo-Pass" coils and the four sprayed condensing coils.

The spray water falls to a tank at the base from which it is recirculated by a pump.

Exhaust air, containing a proportion of hot dry air from the pre-cooling coils, is lowered in humidity so that fog is not blown from the condenser.

In spite of the high capacity provided, the equipment is compact, measuring 14′ × 13′ in length and breadth and 18′ in height. Weight is approximately 20 tons and the largest section weighs only 4 tons. With a boom derrick, the complete condenser has been assembled on the job in 2½ days. It may be installed either on a roof or on the ground—and on roof installations the load is usually far less than the piping, atmospheric condensers, spray ponds, towers, etc., that are replaced.

Recommended application is to refrigeration plants above 400 tons refrigerating so that the operator may obtain the economy that a multiple unit installation gives by varying condensing capacity with the actual refrigeration load.

The manufacturer is the Niagara Blower Co., 405 Lexington Ave., New York, N. Y.

SKF to Install Bearings on 45 Thailand Engines

Installation of spherical roller bearing journal units on 45 Diesel-electric locomotives for the Royal State Railways of Thailand will be made by SKF Industries, Inc., it is announced.

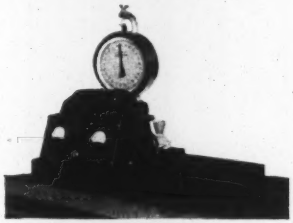
• Keep Informed

Richard H. DeMott, president of the ball and roller bearing company, said 420 journal boxes and 840 spherical bearings would be required for the locomotives which will be built by Davenport Besler Corp. of Davenport, La.

Thirty of the locomotives are 78-ton 4-4-0 units incorporating two 500-horsepower motors. The remainder are 53-ton 0-6-6-0 units with one 500-horsepower motor. They will have a maximum speed of about 43.5 miles per hour.

G. E. Announces Fractional-Hp Dynamometer for Small-Machine and Appliance Manufacturers

An improved design of fractional-horsepower dynamometer set for small-machine and appliance manufacturers use has been announced by the Special Products Division of the General Electric Co. Developed by the company's General Engineering and Consulting Laboratory, the instrument is designed to aid in analyzing and demonstrating the operation of fractional—hp motors, generators and dynamometers.



The equipment also permits the testing of internal combustion engines and other mechanical equipment of similar rating. According to G.E. engineers it is comparable in quality and general features to the larger conventional dynamometer equipments that have been useful in industry and college laboratories.

Engineers explained that the fractional-hp dynamometer equipment will be valuable to manufacturers of small machines and to motor repair service shops in: 1. Obtaining performance curves on small motors and generators. 2. Checking power requirements of small machines such as fans, pumps, and compressors. 3. Testing small engine auxiliaries. 4. Aiding appliance manufacturers in determining the proper motor for their equipment.

The equipment will find application in vocational schools, technical institutes and college engineering departments in: 1. Demonstrating motor and generator characteristics. 2. Checking performance of units built by students. 3. Demonstrating principles and uses of dynamometers. 4. Determining starting and maximum running torques.

The dynamometer is a self-contained unit with extended base to allow for mounting of the equipment under test. A control panel contains instruments for reading field voltage and armature current, a field control rheostat and a three way switch for selecting desired resistance loads. It has a preloaded scale, permitting direct readings with the unit operating as a motor or generator. Optional tachometer equipment can be used because of the double shaft extension. Trunnion mounting with ball bearings independent of shaft bearings reduces static losses to a minimum.

Continued on Page 46

Precision Rod Cutting at High Speed

with the New

DI-ACRO ROD PARTER

The DI-ACRO Rod Parter further increases the applications of "DIE-LESS DUPLICATING" as a cost-cutting, time-saving production technique so well established by DI-ACRO Precision Benders, Brakes and Shears.

Do you require precision?—The DI-ACRO Rod Parter holds tolerance to .001" on duplicated cuts. The ends are square, and roundness is maintained.

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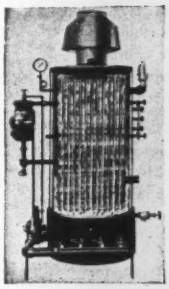
the KANE BOILER PACKAGE



The KANE Boiler built to ASME specifications. In sizes to 30 H.P.

Each KANE BOILER PACKAGE is carefully considered by us as an "individual" job — from the customer's requirements to the finished unit. And each BOILER PACKAGE is a compact, self-contained steam source that includes: the correctly sized KANE Automatic Gas-Fired Boiler complete with gas burner and controls to maintain required steam pressure; and an M-K-O Automatic Boiler Feed system designed to return condensate and supply make-up water as required for highest operating efficiency.

Engineered Steam at its best, with four decades of experience at your disposal — so, send your steam problem to us for study and recommendation.

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No. 47—Product of
Therm-O-Disc, Inc.
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Makes THERM-O-DISC Controls COMPACT • CONVENIENT • DEPENDABLE

Therm-O-Disc Type RC and RA preset controls are actuated by a 1½" snap acting disc of Chace Thermostatic Bimetal. Suitable for fan motor control, limit control in relay circuits, and control and overtemperature protection for resistance loads, they offer advantages directly traceable to their use of Chace Thermostatic Bimetal as an actuating element.

Therm-O-Disc controls are

- *COMPACT* . . . The complete unit fits in the palm of your hand; makes Therm-O-Disc a practical protection package. The small space required by the Chace Bimetal actuating element makes this possible.
- *CONVENIENT* . . . U/L lists them for use where proper terminal enclosure is provided when assembled into the device they control or protect. This eliminates further testing of the control or thermostat when used on products requiring U/L approval . . . means savings for original equipment manufacturers.
- *DEPENDABLE* . . . The sure snap action of the Chace Thermostatic Bimetal actuating element gives the rapid response required in thermostatic controls . . . and Therm-O-Disc *knows* that each control they produce will furnish this rapid response. Constant rigid quality control during the manufacture of Chace Bimetal justifies this confidence.

Chace Thermostatic Bimetal is available in strips, coils, random lengths, finished parts or sub-assemblies ready for installation in your product. If your product controls, indicates or responds to changes in temperature . . . its actuating element should be Chace Thermostatic Bimetal! The Chace Application Engineer can help in determining your bimetal requirements. We invite you to take advantage of his experience.

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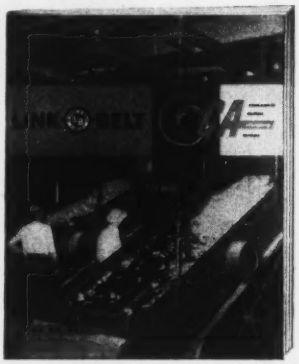
W. M. CHACE CO.
Thermostatic Bimetal
1619 BEARD AVE., DETROIT 9, MICH.

• Keep Informed

The equipment has a continuous absorption or motoring rating of 3/4 hp at 2000 rpm. Maximum permissible safe speed is 4000 rpm. Included in the set is a 10-inch diameter dynamometer scale graduated in pounds with 0.1 pound subdivisions. The scale is pre-loaded which allows torque reading in either direction of rotation.

New Book Published on Link-Belt "CA" Concentric Action Vibrating Screens

Link-Belt "CA" Concentric Action Vibrating Screens for medium and heavy duty service, accurate sizing, thorough rinsing and rapid dewatering of a wide range of materials, ranging from Ashes to Zinc ore, are illustrated, described, tabulated in a new 12-page Link-Belt Book No. 2354 which is now available for distribution to interested readers.



The "CA" vibrator mechanism imparts a smooth, positive, circular motion to all screening surfaces. Its amplitude of vibration is easily adjusted to eliminate blinding caused by sticky clays; to speed removal of fines from stones or chemicals; or to insure sharp separation in sizing of ores, aggregates or coal.

"CA" vibrating screens are made in sizes ranging from 3-ft. wide by 8-ft. long to 6-ft. wide by 16-ft. long screening surface; in single, double or triple deck models; and for suspended or floor mounting.

Detailed dimensions, weights, and other engineering layout data are given, including a page on how to select the right size of screen for handling a given capacity of material per hour square openings of up to three inches.

Hand Trucks in Two Power Types Announced by Clark

Hand trucks in two power types but of one basic design have been added to the expanding line of modern materials handling machines produced by Clark Equipment Company, for more than 30 years a leading manufacturer of fork-lift trucks, Tructractors and industrial towing tractors.

One of the new trucks, the Electro-Lift, is battery-powered with motor drive; the other, the Hydro-Lift, is gasoline engine-powered with hydraulic pump and motor drive. Each model, it is said, possesses certain definite advantages for particular handling operations.

Noteworthy features emphasized in the announcement of the new trucks include: Compact Design—claimed to have the shortest turning radius and shortest wheelbase of any truck of this type. High Maneuverability—ease of operation in

THOMAS Flexible ALL METAL COUPLINGS

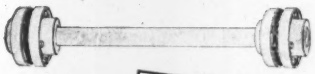
FOR POWER TRANSMISSION REQUIRE NO MAINTENANCE

Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:

½ to 40,000 HP
1 to 30,000 RPM

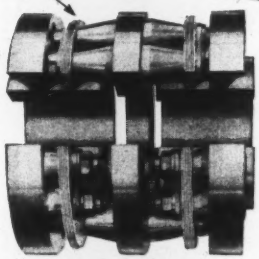
Specialists on Couplings for more than 30 years



BACKLASH FRICTION WEAR and CROSS-PULL are eliminated

Lubrication is not required!

PATENTED FLEXIBLE DISCS



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.

NO MAINTENANCE PROBLEMS.

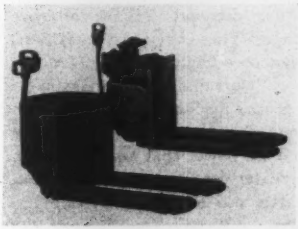
ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

Write for the latest reprint of our Engineering Catalog.

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

• Keep Informed

narrow aisles, vehicle bodies, close quarters. Motor mounted in the Drive Wheel—in both power types. Power Reserve—ample power for peak loads on ramps in both power types. Accessibility for Ease of Maintenance—said to be greater than in any other machine of its type; vital parts easy to get at, all lubrication points on the outside. Ample Underclearance—prevents "hanging up." Gradability—more tractive ability, it is claimed, than any other hand truck. Reduced Wear on Rubber and Floors—because of large (14-inch) drive tire, which carries larger proportion of load, lessens load and wear on rollers. One Rugged Frame—for both models, built for long life. Drive Unit compact, fully enclosed. Largest Brakes, mechanical self-energizing, it is said, of any hand truck.



The battery-powered Electro-Lift is driven by a new GE compound motor which develops 1¼ HP—more power than any other electric powered hand truck. Automatic acceleration prevents overloading of driving motor and dumping of loads, and provides a smooth, swift get-away. The motor is mounted inside the 14-inch drive wheel; and the output shaft drives through a triple reduction of 32 to 1 into an internal gear attached to the wheel. The entire drive unit is completely enclosed with full protection from dirt. The motor maintains almost uniform speed on levels, whether the truck is loaded or empty; and has an extraordinary power reserve for ramp work. The brake is self-energizing, of external contracting type, applied to a 9½-inch diameter by 3-inch surface on the wheel. In addition, an exclusive feature of the Clark truck is a soft, dynamic braking effective automatically when the operator takes his hand off the control button—a smooth deceleration which protects the load effectively.

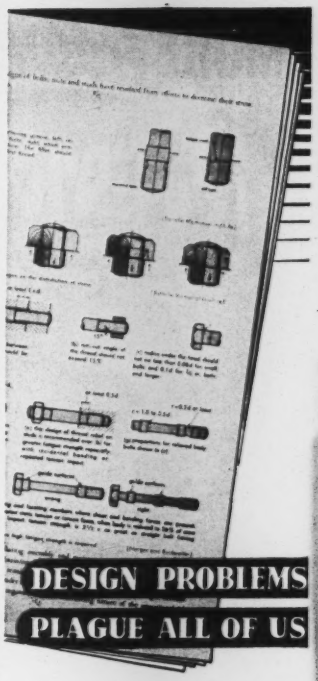
The control panel provides two points of power in each direction; and a walking beam in the control head makes it impossible to direct current to the motor in both directions at once. When reversing direction, the walking beam assures that controls will pass through neutral, then first point of power in the other direction before the second point of power becomes available.

In the compact hydraulic lift system the pump motor, pump, reservoir, relief valve and control valve are designed in one unit with a single line running to the lift cylinders.

This type of drive—a gasoline engine driving a hydraulic pump and motor—is said to be infinitely smoother than any other type and the Clark powered hand truck is believed to be its first application in the Materials Handling field.

In the Hydro-Lift the hydraulic motor is mounted in the same manner as the electric motor—in the 14-inch drive wheel, with the output shaft driving through a reduction to an internal gear in the wheel.

Continued on Page 48



To serve well, a machine part—even when made of good steel, properly treated—must be properly designed.

A new 72 page booklet, sent free on request, discusses the vital relation between design, good steel and its satisfactory treatment.

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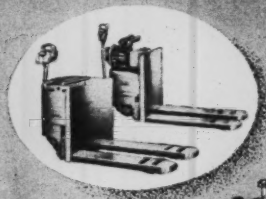

STEADILY RISING COSTS—growing user demands—imminent labor shortages! These very real conditions need not pose frightening problems to alert and able management. Given proper machines, manpower can deliver a great deal *more* power—and enjoy doing it; more power that translates into greater production at lower cost. Now that CLARK has added Powered Hand Trucks to its *Leadership Line* of Fork Lift Trucks and Industrial Towing Tractors, it is better fitted than ever before to help Management meet the challenges of a most critical era. For it is in the field of Materials Handling that the greatest opportunities for savings, for increased production, for improved efficiency and for the betterment of employee relations are to be found. In every piece of CLARK materials-handling equipment, there is MORE POWER FOR MANPOWER. And it is yours to employ—yours to enjoy.

CLARK will exhibit at the Plant Maintenance Show, Cleveland, Ohio, January 15-18, 1951.

Let us send you a concise, easy-to-read catalog on CLARK'S Leadership Line. Just fill out and mail the coupon.

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AND POWERED HAND TRUCKS • INDUSTRIAL TOWING TRACTORS

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8 TRAINED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

• Keep Informed

The gas engine drives a hydraulic pump of eccentric vane type with infinitely variable displacement from zero to 15 gallons per minute. Displacement responds automatically to pressure requirements the delivered volume of oil increasing as pressure decreases.

The pump in turn drives a constant displacement hydraulic motor of vane type with a sequence valve. Hydraulic pressure keeps the vanes in contact with the case at low speeds. It is claimed that the motor develops 90 per cent of full torque below 10 rpm.

Automatic torque multiplication provides ample reserve power when it is needed; and for that reason, the truck is said to possess exceptional ability for ramp work. The eccentric pump makes it impossible to stall the engine; and a unique valve linkage to the throttle provides finger-tip reversing.

The Hydro-Lift engine is 2-cylinder opposed type, air cooled, and rated at 5.5 BHP at the governed speed of 2800 rpm. A mechanical governor and fuel pump are standard equipment.

The same frame, of rugged construction, is used for both models. Other units standard for both models are the tires, brakes and brake linkage, forks and rollers, slides, lift cylinders and linkage, main carrier bearing, and handle—except the controller.

Mechanical brakes of self-energizing type are actuated by movement of the handle to extreme position, either up or down.

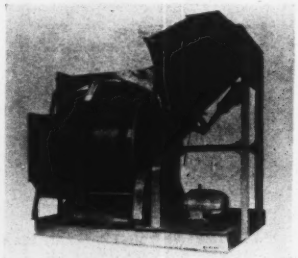
Both models are rated up to 6000 pounds load capacity.

These machines are not available for export sale.

A descriptive booklet containing complete information on the new hand trucks may be obtained upon request on business letterhead to Clark Equipment Co., Industrial Truck Division, Battle Creek, Michigan.

Rotary Batch Mixer Announced by Worthington

Worthington Pump & Machinery Corp., Dunellen, N. J., recently announced a Batch Mixer offering maximum protection from dust hazards. To eliminate dust during discharge of batch, a dustproof housing enclosing the discharge chute is furnished.



The sealing joint packing on discharge side of drum revolves with the drum. The discharge housing portion of the seal remains stationary. To eliminate dust during mixing period a sealing disc is furnished attached to inner side of discharge chute, completely closing discharge opening while mixing. Spring and bearing on outside of sealing disc keep disc centered at all times. A simple adjustment furnished allowing "take-up" to provide for wear. Sealing joint packing revolves with the drum on the charging side. Packing is kept in place by a retaining ring accurately bolted to true center of drum

with adjustment provision for keeping packing tight.

The units embody the well-known Ransome mixing action where the mixture goes up both sides, falls in two fanlike formations to bottom, is swished from side to side, carried up again and operation repeated. When mixed the material is discharged, leaving the drum completely clean of all, including the finest materials.

Complete details in Bulletin #R1-1 504.

Yale Link Chain Model Pul-Lift

A new link chain model Pul-Lift, a portable device for hoisting or pulling has been announced by the Philadelphia Div. of the Yale & Towne Manufacturing Co. With the use of link chain, the applications of the Pul-Lift are now multiplied to include thousands of new maintenance and production jobs in small plants, large plants, garages, construction projects, utilities, refineries, quarries, and machine shops. Work positioning, hoisting, stretching trolleys, telephone wire and even cables are just a few of the suggested uses.

The Pul-Lift is as simple to operate as a wrench and its light weight construction makes it almost as easy to carry to the job. At any point of the lifting action, the load is safely supported by a positive, self-actuating load brake.

The Pul-Lift, like all Yale hoists has safety top and bottom hooks that open slowly without fracture when overloaded. The bottom hook is ball bearing mounted for swiveling.

The link chain Pul-Lift is available in $^3/_4$, $1^1/_2$, and 3 ton capacities from the Philadelphia Div. of the Yale & Towne Manufacturing Co., 11000 Roosevelt Boulevard, Philadelphia 15, Pa.

G-E Control Used In Automatic Pumping Station For Shell Oil Pipe Line

A "telephone" dial on a dispatcher's desk in the Shell Oil Company's New York City office now operates, by remote control, four new, G-E equipped, automatic pumping stations on the oil company's eight-inch petroleum products pipe line almost 1000 miles away.

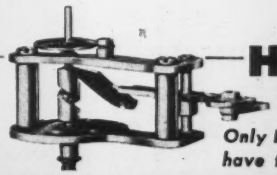
This new method of pipe line control, believed to be the first of its kind in the world, was developed to meet the increased demand for petroleum products through Shell's East Products Pipe Line, transversing Illinois, Indiana, and Ohio. This demand is particularly large during the winter months when fuel oil predominates. To meet this required increase, four new pumping stations were installed between the Wood River, Illinois refinery, near St. Louis, and Columbus, Ohio, each with a single 500-hp pump motor. The stations are designed to be as fully automatic as possible so that the dispatcher can

Continued on Page 50

"Vive la Difference!"

• At one time the French Chamber of Deputies was debating women's suffrage. When one liberal soul pointed out that there was very little difference, after all, between the sexes, a fellow deputy leapt to his feet and shouted with gusto, *"Vive la difference!"*

Two pressure gages may seem alike. But the difference between a HELICOID and any ordinary gage is unique. So much so that otherwise complacent engineers, who usually keep their feet on the ground, have been known to jump with ecstasy and exclaim, *"Vive la difference!"*



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start or stop the station and take instrument readings from his desk in the RCA building, New York City.

In order to make best use of the existing leased network teletype facilities, General Electric and Shell engineers collaborated with American Telephone & Telegraph, and as a result, teletype relay equipment functions in conjunction with the G-E MI-9 switchgear as a part of the complete system of switchgear, control, and accessory equipment that G-E furnished for the four automatic pumping stations.

These relays permit the G-E switchgear to set up a "Station Run" sequence at any one of the four new stations when the proper code letter is dialed in the dispatcher's office. The "Station Run" sequence: (1) Starts an oil pressuring pump to lubricate seals in the main pump; (2) Opens the motor-operated suction valve; (3) Starts the 500 hp pump motor (full voltage start); and (4) Opens the motor-operated main discharge valve to bring the station on the line. Shutdown is then affected by opening the "Station Run" relay, which shuts off the pump motor *and* simultaneously closes the motor-operated valves. A mechanical check valve in the line permits pipe-line flow to go past the pump when these valves are closed.

Dialing another code letter allows the dispatcher to read the instruments at any one of the four stations in rapid sequence over the teletype system. General Electric also furnished a Bailey pulse duration telemeter system in the MI-9 cubicle, which, in conjunction with pressure recording instruments both ahead of and behind the pump and a motor current recorder, causes the teletype to transmit letters which can be read by the dispatcher in terms of instrument readings.

To assure against equipment failure or fault in operation, each station, according to a G-E engineer, is equipped with a very complete complement of safety shutdown devices. In the event any one of the safety devices trips, the station is shut down, and an annunciator (in the MI-9 equipment) registers the cause of the trouble. If any safety device is tripped, it locks out the station and makes it impossible to restart the station until an attendant is called and the trouble located.

The four new "booster" stations are equipped with 500-hp motors and pumps. However, the stations are designed with pump bases and pump mounting arranged to permit future installation of 900-hp, wound-rotor, base-ventilated motors. This design was approved after a study made by G-E engineers comparing costs on three pipe line pumping systems showed favorable results

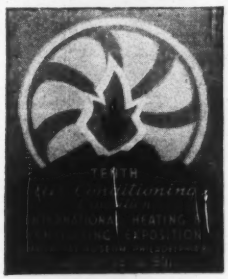
General View of 9th International Heating & Ventilating Exposition at Chicago in 1949.

You Can Profit from this Panorama of Progress

Whatever your interest in HEATING, VENTILATING and AIR CONDITIONING, it will pay you to come to Philadelphia's huge Commercial Museum next January 22–26. Here you will see over 300 exhibits of the latest products and advanced practices for conditioning air in all types of buildings, industrial plants, institutions, and homes . . . the largest event of its kind ever held. An unequalled opportunity for you . . . to see and compare hundreds of new and improved cost-saving items ranging from complete units to maintenance supplies . . . to get time-saving solutions to problems . . . to discuss future plans and requirements first-hand with engineering specialists. You'll come away with more good, practical ideas than you could get in any comparable time or way.

So plan *now* to attend . . . and profit from this most instructive, valuable exposition.

Auspices of The American Society of Heating and Ventilating Engineers



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International Exposition Company

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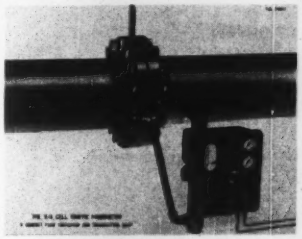
under certain loadings for adjustable speed electric motor drive. The control, switchgear, and instrumentation is also being arranged so that it can work with the 900-hp motors, since it is anticipated that within the next few years further increase in load on the East Pipeline will justify installation of the larger motors and possibly the adjustable speed drive at these four new stations.

The V/A Cell



The Fischer & Porter V/A Cell is a new, precision flow transmitter developed for differential pressure applications. Being basically a through-flow instrument of the variable-area type it measures a by-passed portion of the main-line flow. Continuous self-purging is thus provided. It features high accuracy with wide-range, linear scale. It is mercuryless but does not utilize a diaphragm of any kind. Manifold systems, bellows, seals, exterior purges, condensate chambers, are all eliminated. The V/A Cell is applicable to services on liquids, gas, and vapor streams including steam. 316 stainless steel is standard material for all wetted parts. Changing the flow range of the instrument is accomplished with extreme simplicity. Further information can be obtained by writing Fischer & Porter Co., 42 County Line Road, Hatboro, Pa.

New Plastic Provides "Internal Vision" for Engineers

A new plastic that can be made into scale models of machine parts and tools, now is providing "internal vision" for engineers in military, university, and industrial laboratories here and abroad, according to the Westinghouse scientists who developed it.

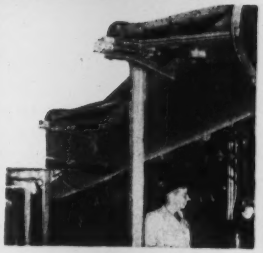
First announced as a laboratory creation more than a year ago, the new "photo-plastic" is aiding researchers in gun factories, airplane engine plants, arsenals, naval laboratories, and universities in the design of stronger machinery and equipment. The three-dimensional scale models cut from the plastic enable scientists to get a "portrait in color" of the strains encountered in tools, machine parts, and other objects.

Co-developed by Milton M. Leven and Herbert F. Minter of the Westinghouse Research Laboratories, Pittsburgh, Pa., the plastic can be cast in cylindrical or rectangular chunks 8 inches in diameter or in width and 36 inches in length. Previous "photo-plastics" were limited to flat pieces not more than an inch and a quarter in thickness.

One of the major applications of the new material is in the design of breech blocks for big guns. To understand the terrific stresses these parts undergo during firing of the gun, an exact three-dimensional model of the block has been built and "loaded" to simulate the stress.

Continued on Page 52

Ledeen cylinders improve the job



CYLINDERS PROVIDE AUTOMATIC OPERATION OF FLUE DAMPERS

Individual operation of 13 flue dampers, in a smoke filter system, is provided by 13, 2" diam. x 6" stroke Ledeen Heavy Duty Cylinders. Dampers divert smelter smoke through bag filters, to remove metallic content, as part of a smoke abatement program.

System is automatic, controlled by a central timer on a planned cycle. 100 P.S.I. plant air supply operates each cylinder on impulse from the timer. Manual operation is completely eliminated.

Standard Ledeen cylinders and mounting attachments are available from distributors' stock in major cities. Special cylinders on order.

Write for New Bulletin 500.

There are Ledeen *Medium Duty, Heavy Duty* and *Super Duty* cylinders for air, oil or water operation ready to help you, wherever you have to push or pull • lift or lower • press or squeeze • tilt or turn • open or close

Ledeen Cylinders are Good Cylinders • Ledeen Cylinders are Good Cylinders • Ledeen Cylinders are Good Cylinders • Ledeen Cylinders are Good Cylinders •

Ledeen Mfg. Co.
1600 San Pedro
Los Angeles 15, Calif.

CUT PRODUCTION and MAINTENANCE COSTS

with FACTORY-ASSEMBLED Pangborn UNITS!

These inexpensive, ready-to-use Blast Cleaning and Dust Collecting units earn you extra profits where custom-built equipment is not practical.

BLAST CLEANING CABINET

cleans metal parts, removes rust, scale, grime, dirt, paint, etc., in a few seconds. Ideal unit for producing clean, smooth surface on pieces up to 60″ x 36″.

BLAST CLEANING CABINETS $318.00 and UP

BLAST CLEANING MACHINE

for maintenance and many other uses including the removal of rust, dirt, scale, etc. Economically cleans large objects such as tanks, bridges, structural work preparatory to painting. Six sizes, stationary or portable.

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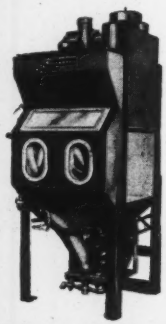
UNIT DUST COLLECTOR

traps dust at its source, minimizes machine breakdowns, reduces housekeeping and maintenance costs. Solves many grinding and polishing nuisances and material losses.

UNIT DUST COLLECTORS $286.00 and UP



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uses liquid blast, eliminating dust, and reduces costly hand polishing, cleaning and finishing of molds, dies, tools, etc. Removes scale, discoloration and directional grinding lines, prepares surfaces for plating and coating. Holds tolerances to .0001″.

HYDRO-FINISH CABINETS $1295.00 and UP

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PANGBORN CORP., 3200 Pangborn Blvd., Hagerstown, Md.
Gentlemen: Please send me further information on—
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I am interested in the possibility of using one of these machines for.....
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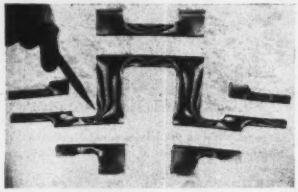
When frozen into the material and then viewed through special polarized light, the stress pattern appears as a series of varicolored lines that tell the scientist where the major stresses are located, in which direction they are acting, and just how great they are.



In addition to its use in Westinghouse laboratories, the new plastic also is being used by scientists at Rolls-Royce Company, Ltd., one of England's leading airplane engine manufacturers, National Tube Co., U. S. Naval Gun Factory, David Taylor Model Basin, Watertown Arsenal, Massachusetts Institute of Technology and the universities of Purdue, Cornell, and Harvard.

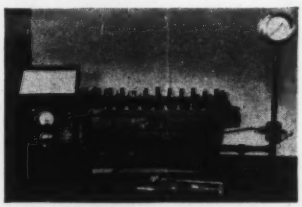
Even medical scientists may find the new material of great value because experimental leg-bone models have shown that internal stresses in human bone structure—such as those caused by fractures or heavy blows—can be clearly viewed and analyzed.

The new plastic is a modified form of Fosterite—the tough, waterproof material developed by Westinghouse scientists during World War II to seal radio and radar parts against harmful moisture.

This type Fosterite is 35 per cent more sensitive than the standard photo-plastic. As a result, many more stress lines appear when the model, or a slice of it, is viewed through polarized light. Since counting these lines is an essential part of analyzing the stress pattern, the more lines there are, the more accurate the diagnosis.

Baldwin Locomotive Works Fabricated Steam Chests

Design of this fabricated steam chest was based to a large extent on resistance wire strain gage measurements on the walls, cover, and bolts. SR-4 gages were bonded to interior and exterior walls at 14 points and to the center of the cover. Four additional gages were bonded 90 deg. apart on each of two studs in the centerline of the long sides and cover so as to give axial strains and stresses.



Studs on which strain gages were attached were turned down from $\frac{7}{8}$ inch to 0.720 inch diameter for a length of $1\frac{3}{8}$ inch. Leads from these gages were brought out through grooves cut in the flange from the bolt hole to the outside. Leads from internal gages were taken through piping used in applying hydraulic pressure to the chest, to a manifold having six automobile spark plugs

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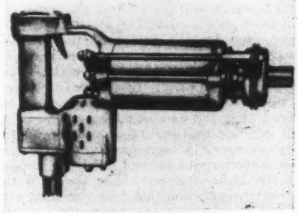
fitted to it, as shown at the right. Lead wires were soldered to the center electrodes on the inside and connections were made to the outer terminals.

Strains were measured when the pressure in the chest had been raised to 1200 lb. per sq. in., double normal operating pressure. The system was filled with SAE-10 oil and the hand pump in the foreground was used to produce the desired pressure. A 21-point transfer switch (not shown) was used with the Baldwin SR-4 strain indicator (left) to speed up the testing and calculating program.

A. W. Brunot and W. G. Schmittner, Thomson Laboratory, General Electric Company, Lynn, Mass., reported that results of the tests were the basis for a decision to build steam chests with curved walls whenever practical and to fasten the cover to the flanges by studs located inside the centerline of the walls where they join the flange. The gages showed further that stud bending moments may be excessive unless nuts and bolts are carefully produced so as to keep nuts parallel to the cover.

New Electromagnetic Hammer Drill

A brand new electromagnetic Hammer Drill—the Model No. 10-RO—for highspeed hole drilling in concrete, brick and stone, has been added to the line of Electric Hammers manufactured by the Syntron Co., 498 Lexington Ave., Homer City, Pa.



The automatic rotation of the carbide-tipped spiral drill speeds up hole drilling, eliminates manual turning of the drill chuck and reduces fatigue. This automatic rotation of the drill bit is accomplished by a rubber ratchet mechanism actuated by the recoil of each blow of the Hammer's piston (3600 blows per minute).

The Hammer's light weight (11¾ lbs.) together with automatic drill bit rotation, make it an ideal hammer for easy, one-handed drilling of a lot of holes in awkward places, such as up on ladders, scaffolding, etc.

Descriptive literature is available from the manufacturer.

Puget Sound Plywood, Inc. Installs New Type G-E Drive

In the first installation of its kind, amplidyne and electronic control will be used to provide a completely co-ordinated drive on a veneer lathe, pressure roll, tipple and trays for Puget Sound Plywood Inc., Tacoma, Washington. This equipment is being supplied by General Electric.

In operation, a thin sheet of veneer is peeled from the full length of the log and placed between two chuck centers. The knife is advanced at a specified rate so as to produce a continuous sheet of veneer of uniform thickness. The sheet is in turn picked up by the tipple which feeds the veneer to the selected storage trays. These trays are

Continued on Page 54

with Pangborn Dust Control there's...

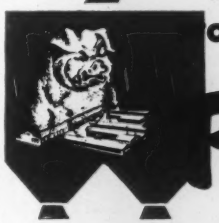
DUST used to blanket the Daystrom plant and nearby neighbors in Olean, N. Y. But no more! Since Pangborn Dust Control equipment was installed, 788 cubic feet of dust has been removed from the air every 16 hours. That's enough dust to fill an average room right up to the ceiling!

Profits from the Pangborn Dust Control system are already visible at Daystrom. Electric motors, precision machinery and even the interior paint job all need far less maintenance. In addition, there's a bonus: the dust collected can be burned—which adds up to a big cash saving on fuel.

HOW ABOUT YOUR PLANT?

Find out about Pangborn Dust Control. A free "Pangborn Dust Survey" costs nothing—but will show you how to *turn dust into profits.* Write for details and a copy of Bulletin 909A to: PANGBORN CORPORATION, 2200 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Dust Control and Blast Cleaning Equipment



STOP THE DUST HOG from stealing profits with Pangborn DUST CONTROL

The FASTEST way to get

Surface Roughness Ratings in the Shop

At Allied Products Corp., Hillsdale, Michigan . . . the Profilometer Type Q Amplimeter, the Type A Linear Pilotor and KA Tracer in use.

is with

THE PROFILOMETER

Where precision parts are produced in high volume—as they are at Allied Products Corporation—both production inspection and final inspection operations must be geared to handle a steady and substantial flow of work. When surface roughness measurement is a production requirement, it is the Profilometer that provides the fastest and simplest method of securing accurate readings.

The Profilometer has a normal tracing speed of 1/3" per second—far faster than any other instrument of its type. And in the time required to make a shop check of surface roughness by comparative methods, you can take *several* Profilometer readings. In addition, Profilometer equipment can be moved from machine to machine and set up quickly and easily.

Of most importance, you get this speed of surface roughness measurement where you need it—*in your production departments.* Because the Profilometer is a ruggedly built instrument, it can be used anywhere in the plant and operated next to machines by the set-up men or the machine operators themselves. It is designed not as a laboratory instrument but as a shop tool.

Regardless of the type or volume of your production, you will always find the most *practical* method of measuring surface roughness in the shop is with the Profilometer.

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Profilometer is a registered trade name.

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actually conveyors arranged in a stack, one above the other.

The General Electric Veneer Lathe Drive is a direct-current system, utilizing amplidyne control to obtain the maximum performance from the drive components. The "key" to the drive is the use of an "amplidyne" exciter. In appearance and maintenance, the* amplidyne resembles a conventional direct-current exciter. However, where the ratio of power output to excitation power for a conventional exciter may be 25/1, the same ratio is 1000/1 for the amplidyne. This means that the veneer lathe drive is controlled by currents amounting to a fraction of an ampere.

The drive is designed to hold constant veneer cutting speed as the log diameter changes. The unique combination of a motor-mounted tachometer generator and knife-operated rheostat produces a voltage directly proportional to veneer sheet speed. This voltage is balanced against a fixed voltage and any difference is impressed across an amplidyne control field. Since an infinitesimal amount of amplidyne excitation controls the amplidyne output, this small voltage difference controls the speed of the driving motor.

The co-ordinated drive also includes a 7½-hp motor to drive the tipple conveyor, and a 15-hp motor to drive the storage trays. Control is arranged so that the speed of the tipple and tray conveyors will be equal to and will follow linear sheet speed of the peeled veneer as it comes from the lathe.

A 3-hp pressure roll Thy-mo-trol* drive is being used for the first time to maintain constant torque on the roll above the knife. Standard wound rotor motors with 50 per cent fixed secondary resistance are commonly used for this application. It is expected that the new constant torque drive will improve the quality of veneer and the performance of the equipment.

A master speed control lever is provided for the lathe operator. The speed of the entire system is controlled by this lever and all drives will stop when the control is in the OFF position.

*Registered Trade Mark

Helicoid Square Flush Case Gage

Helicoid Gage Div., American Chain & Cable Co., Inc., announces a new gage case for flush mounting gages on panels. This new square case has the same bolt circle and the same round cut-out in the panel as standard round flush cases of the same dial size. The width of the square front flange is considerably less than the diameter of the conventional round front flange. The new square case takes up less room and is particularly suitable for panel installations to match other square case instruments. Available in 4½", 6" and 8½" dial sizes.

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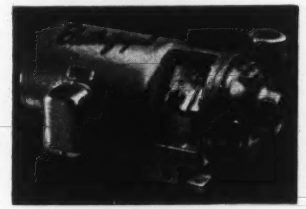
Electrifugal Pump

A redesigned close-coupled Electrifugal pump and motor with internal and external design changes to provide improved operating characteristics and greater ease in maintenance has been announced by Allis-Chalmers Manufacturing Co., 949 S. 70th St., Milwaukee, Wisconsin.



The improved unit has new sealed motor bearings; a unit-cast frame which provides perfect and permanent alignment; double seal on front motor bearing which keeps liquid out of the bearing under normal operating conditions, and a large opening in the frame between the pump and motor to make packing maintenance quick and easy. Its all cast iron construction resists corrosive atmospheres. Its appearance is sleek and streamlined.

The pump is available with removable casing in some sizes and with removable cover plate in others. It can be had in ratings from 10 to 500 gallons per minute at heads to 220 feet.

The motor is designed and built especially for the Electrifugal pump. It has a double-dipped and double-baked stator, a rotor of pressure die-cast aluminum construction, and ventilating fans which move the air from the rear of the motor to the pump end. Motors range in size from ¾ to 10 horsepower. They are available in drip-proof, splash-proof, totally-enclosed fan-cooled or explosion-proof types.

Worthington Announces New 30 Ft. Portable Air Compressor

A new compressor described in Bulletin H-850-B72 is announced by Worthington Pump & Machinery Corp.

Two-staged, air-cooled, this 30 cu ft capacity compressor has a maximum operating pressure of 150 lb. It is equipped with: ASME air receiver, oil bath air cleaners, protective V-belt guard.

Features include: circumferential cooling fins, tube and fin type air-cooled intercooler, positive by-pass unloader holds inlet valve open during idling period, Worthington Feather Valve, separate, close-grained cast iron honed cylinders, full floating wrist pins, oil dippers for controlled lubrication, aluminum low pressure piston and cast iron high pressure piston of equal weight for proper balance.

This compressor is available in either a trailer model having an overall length of 74 5/8 in. or a hand truck model with an overall length of 65 in. Please request copy of this bulletin on a company letterhead.

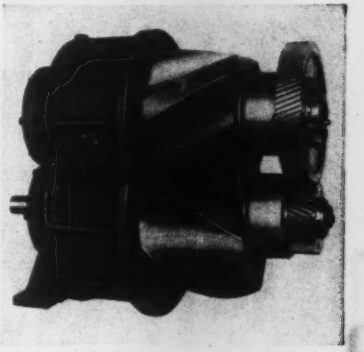
New Automatic Carbon Content Control for Homocarb Carburizing Furnaces

New development by Leeds & Northrup Company makes it possible for heat-treaters to do something they have never been able to do before with a heat-treating furnace—that is, measure and control the carbon

Continued on Page 56

STANDARDAIRE

Precision Built Axial Flow



BLOWERS handle the movement of air gently by screw action instead of paddle action, as is the case with other positive displacement blowers. Result—air pulsations and noise are reduced to a surprisingly low level. In Standardaire Blowers the revolutionary new form of the rotors marks a major improvement in blower design. The rotors are produced by an exclusive rotary generating process, the form and helix being controlled entirely by the machine gears. This produces rotor threads that are accurately shaped and machined to close tolerances for efficient blower operation. The design of the rotors and other construction details makes possible internal compression to a degree that Standardaire Blowers operate on a modified adiabatic cycle with a lower mean internal pressure. This important feature, together with advanced engineering throughout, makes for a quiet, compact, efficient blower with long service life.

Write for Standardaire Blower Bulletin covering dimensional information. Publication No. 88.

The Standard Stoker Company, Inc.,
Dept. C-6, 370 Lexington Ave.
New York 17, New York

Standardaire Blower equipped with unique pulley attachment for belt drive, when required.

THE STANDARD STOKER CO • INC •

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simplified installation

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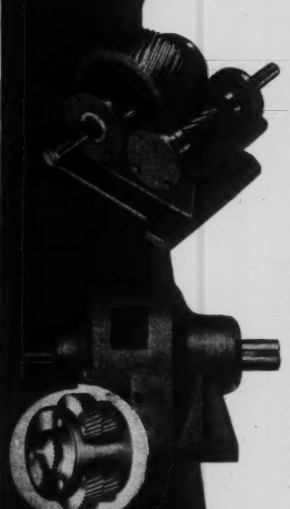

Position or space limitations, imposed on a speed reducer by the design of your equipment, need present no problem . . . need not involve a specially engineered unit.

There's a compact, fully standardized Winsmith reducer (from fractional to 85 H.P.) for practically any condition, no matter how individual. Simplifying your design and installation are extensive Winsmith provisions for horizontal, vertical or flange mounting; diversified shaft positions and alternate directions of rotation.

Such adaptability not only simplifies design problems for the primary equipment maker, but for the user as well. Often, a deficient "special" reducer can be replaced with a fully standard Winsmith model.

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50th WINSMITH SPEED REDUCERS 1901-1951 ANNIVERSARY

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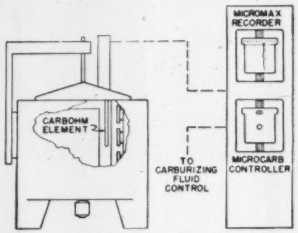
potential of furnace atmosphere directly in terms of per cent carbon. By means of this "Microcarb" control, they can now regulate the surface carbon content of steel during heat-treating as accurately as they regulate temperature. Atmosphere can be adjusted to increase or decrease carbon potential automatically, as required for the work in the furnace . . . for surface carburizing, homogeneous carburizing, carbon restoration hardening and annealing.

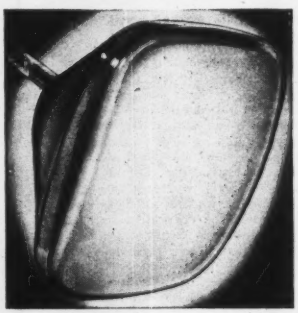


Principal feature of the carbon control system is a Carbohm detecting element, which projects into the furnace work chamber like a Thermocouple, and electrically "senses" the carburizing potential of the furnace atmosphere. Connected to this element is a Microcarb Controller, which automatically adjusts the flow of carburizing fluid to hold carbon potential of furnace gas at any selected value between 0.15 and 1.15 per cent carbon. For the heat-treater's guidance, a Micromax recorder draws a continuous record of per cent carbon as detected by the Carbohm element.

Microcarb Control is supplied only for use with Leeds & Northrup Homocarb furnaces. It can be ordered as an integral part of new Homocarb equipments, or can be added to certain furnaces now in service.

For information, write to Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Pa.

20" Rectangular Teletron Offered to Trade



The Tube Division of the Allen B. Du Mont Laboratories, Inc., is now delivering the new Du Mont 20CP4 rectangular Teletron to the trade. The new tube features the Du Mont Bent-Gun resulting in sharper over-all trace. Among other features is the dark face plate enhancing contrast and reducing bothersome reflections.

The new Teletron is being delivered to manufacturers as original equipment for their receivers, and is also being distributed through the Du Mont Jobbers as a conver-

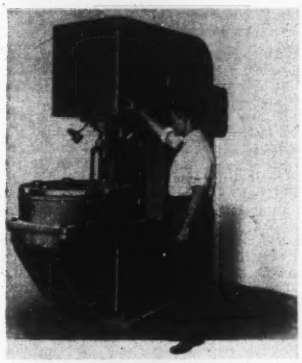
sion item in the ever-increasing trend of converting receivers to larger picture screens.

General characteristics of the tube are as follows: Overall length—21 7/16". Screen size—17" wide × 12 3/4" high. Deflection angle of 70°. Heater voltage is 6.3 volts while the heater current is .6 amps. Maximum anode voltage is 18,000 volts.

Ion trap magnet strength is 52 gauss at 14 KV anode voltage.

Denison Announces New High-Production 50-Ton Oil-Hydraulic Press

Fast action with high-tonnage pressures under accurate, regulative control are announced operational advantages of the new 50-ton Multipress, oil-hydraulic press of The Denison Engineering Co., Columbus, Ohio. Speed and control features in this floor model are said to be available for the first time in a press of this tonnage. Its precision adjustments for multiple ram action give unusual flexibility for applications in many varied industries.



The 50-ton Multipress extends the range of standardized, self-contained oil-hydraulic presses in this line beyond the widely used units of 1 to 35-ton capacity. It has a 15" stroke, 24" daylight opening, and a work surface of 31" × 19 1/2", all of which provide more die space in keeping with their higher tonnage capacities.

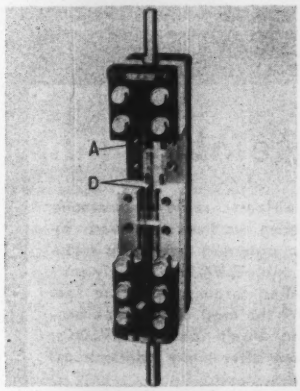
Approach of the ram to work is variable and can be preset at any speed desired up to a maximum of 290 inches per minute, with pressing speeds up to 145 inches per minute. Approach and pressing speeds are independently adjustable, permitting rapid traverse with slow entry of punch into dies, and similar combinations for exacting work requirements. Other operational factors that can also be preset include: ram stroke length and pressure. Either pressure or distance reversal is also a feature of all models of the 50 ton unit.

It is pointed out by the manufacturer that the adjustable characteristics of this high-tonnage, high-speed oil-hydraulic press permit unskilled operators to turn out production quality parts at full speed. Controlled uniformity of finished pieces results in fewer rejects and lower inspection costs. The press may be equipped with a choice of controls including dual hand lever, single lever, foot pedal or electric push-button type. It is available in manual and automatic models for single cycling, continuous cycling, or vibratory repeat strokes. Automatic ram cycling also may be used in conjunction with variable speed approach, and interlocking hydraulic accessories. Added advantages include inching control of ram for quickly locating dies and tooling during set-up periods.

As a further extension of the automatic features of the new 50-ton unit, a large 33" diameter hydraulic index table, may be installed. The Denison table accessory moves parts under the press ram automatically and provides indexing for either 6 or 12 stations. Parts can be loaded onto the table stations at front of the press, eliminating waiting periods for completion of work cycles. The revolving table, synchronized hydraulically with the ram action, accurately positions the parts at the pressing stations. Provision is made for "skipping" non-tooled stations on the index table, if this is a requirement of the work in process. This automatic indexing is said to offer many application possibilities for high-speed, volume production on short or long runs.

Change-over of dies and fixtures on the press and index table can be handled rapidly. The ease of tooling this new 50-ton Multipress and its companion models is reported to reduce press downtime to a negligible production cost factor.

Improved Gaskets for High-Pressure Water Level Gages



When glasses or gaskets of high-pressure water level gages are replaced, Yarway flat-glass inserts are now fitted with improved gaskets coated with special compound that prevents adhering to the gage metal surfaces under high pressure and high temperature service. This Yarway Frelon gasket is the molded pressure-sealed gasket (D) located in the grooves of the gage insert body.

Illustration shows other details of the Yarway pressure-sealed "floating assembly" flat-glass water level gage. Send for water gage Bulletin WG-1811 and for information on these Frelon gaskets. Yarnall-Waring Co., Philadelphia 18, Pa.

New Combination Life-Linestarter

A new combination Life-Linestarter, Class 11-206-N—combining motor starter, motor protection, and disconnect in a redesigned enclosure to save space and increase safety—is now available from Westinghouse Electric Corp.

Designed for across-the-line starting of squirrel cage induction motors, or as a pri-

Continued on Page 58

WORKS WHERE OTHERS WON'T

accurately formed

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SELF-LUBRICATING ● EXTREMELY DURABLE ● CONSTANT CO-EFFICIENT OF FRICTION ● OPERATES DRY — OR SUBMERGED IN WATER, GASOLINE OR CORROSIVE LIQUIDS ● APPLICABLE OVER A WIDE TEMPERATURE RANGE — even where oil solidifies or carbonizes ● EXCELLENT AS A CURRENT-CARRYING BEARING.

GRAPHITE METALLIZING CORPORATION

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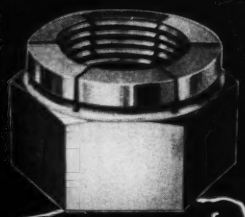
Why FLEXLOC SELF-LOCKING NUTS



"This nut will take the place of the two regular nuts and the washer that is now on this piece."

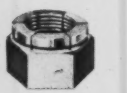
(Part of a letter from a Connecticut distributor.)

···simplify assembly

You can readily see why FLEXLOCs simplify assembly when you read the above excerpt from our distributor's letter. From comments like this we feel sure there must be hundreds of similar cases where FLEXLOC Self-Locking Nuts can be used to advantage.

FLEXLOCs offer these features: *one-piece, all-metal construction*—nothing to work loose or forget, no serious temperature problems; *resilient, automatic locking sections,* processed by our patented method to make possible FLEXLOCs' closely controlled torques; PLUS the fact that the most chattering vibration won't loosen FLEXLOCs, even after many applications.

Why not convince yourself with actual samples? Tell us what size you want and you'll receive them promptly, together with our latest literature.



FLEXLOC Self-Locking Nut, "regular" type.

FLEXLOC Self-Locking Nut, "thin" type.

FLEXLOC Self-Locking Nut, external wrenching type.

SPS STANDARD PRESSED STEEL CO.

JENKINTOWN 20 PENNSYLVANIA

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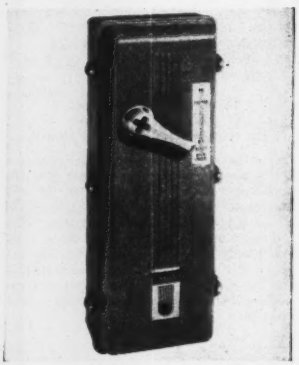
mary switch for wound rotor motors, this unit features the new Life-Linestarter, AB De-ion Circuit breaker, and slamproof self-indicating interlocked handle.



With capacities from 1/4 to 100 hp, and 110 to 600 V polyphase, the unit is available in NEMA sizes 0 through 4, and NEMA type enclosures, 1, 1A, 3, 4, 5, 7, and 9.

The new Life-Linestarter component provides fast, trouble-free operation due to the simple action of a see-saw pivoted on a knife-edge bearing with a kick-out spring to insure positive opening.

Delayed tripping of safe overloads, and instantaneous action on short circuits is provided by the quick-make, quick-break thermal-magnetic AB De-ion Circuit Breaker.

Designed for use with up to three safety padlocks, the slamproof self-indicating handle is also interlocked to prevent opening of the enclosure when breaker is closed.

Standardized enclosures, compact design, straight-through wiring, and front-removable parts provide safe, easy installation and maintenance. Sheet-steel enclosures are Bonderized to increase corrosion resistance.

For further information, write Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

Modern Vehicular Tunnel Uses G-E Switchgear and Control

The recently-opened $7,000,000 Washburn Tunnel, under the Houston Ship Canal, Houston, Texas, has been equipped with the latest tunnel control devices and switchgear supplied by the General Electric Co. The electrical contractor was the Pfeisser Electric Co. of Houston, Texas. Palmer and Baker of Mobile, Alabama, were the consulting engineers. The tunnel has a total length of 3,791 feet between grade points and an inside diameter of 28 feet which will accommodate two lanes of traffic, a police walkway, and power circuits and an air duct. The top of the tunnel is 45 feet below mean low water level in the ship canal, which has a navigable depth today of 34 feet, but the tunnel provides for a future 45 foot canal, 500 feet wide.

Automatic in its operation, the new tunnel has a ventilation system, with three special blower fans in a ventilation building to force fresh air into the air ducts under the roadways. Special G-E starters for each of the three fan drives have been installed. These starters provide reduced voltage starting for the 300 hp motors which drive the fans at high speed and full voltage starting for the

• Keep Informed

40/10-hp. motors which drive the fans at medium and low speeds. Each fan has a top capacity of 342,000 cfm, and two of the units can provide the air supply, while the third serves as a reserve unit. There are no exhaust ducts as in many vehicle tunnels. Exhaust air moves to the portals along the roadway.

Four devices activate the G-E controls which determine the speed of the fans. One device sets up a minimum ventilation schedule for a week's program by means of a program clock mechanism. Another instrument maintains a continuous count of the number of vehicles in the tunnel and steps up the ventilation above this minimum if a number of cars in the tunnel warrants. A third device maintains a continual analysis of the air, and when the concentration of carbon monoxide begins to build up, ventilation is stepped up automatically. Still another device which controls the ventilation is the push button control, located in two places in the tunnel, which is used by the patrol men to increase the ventilation in case the exhaust smoke becomes objectionable. In this way the tunnel is kept safe and comfortable at all times.

A General Electric control board provides control for the a-c and d-c motor-driven generator which supplies power for emergency tunnel lighting. This board also controls the diesel-engine-driven set which supplies emergency power for the entire tunnel. Indicating lights are provided for the pumping system and alarm.

The output signal of the carbon monoxide detector is set into two telemetering transmitters mounted remote from the control board. The signal is transmitted to two continuous graphic recorders, mounted on the control panel and also to a set-up board which provides a means of automatic starting, stopping, or changing the speed of the fans. This arrangement provides automatic control of the ventilating air and insures an ample supply at all times.

G-E low-voltage switchgear is used which includes two AL-2–50–1200-amp transformer breakers, having an interrupting capacity of 50,000-amps to provide short circuit protection. A similar breaker is used as a tie breaker to permit emergency operation of all tunnel equipment from either of the two feeders. This emergency switching is fully automatic.

The breakers supplying power to the fan drives have 600-amp capacity with 25,000-amp interrupting capacity. Short circuit protection for normal and emergency tunnel lighting, billing lighting and pumps for removing storm and wash water is provided by twelve 225-amp capacity breakers, 15,000-amp interrupting capacity. They also serve to connect the generator of the emergency power set to the tunnel distribution system in case of power failure on both of the normal supply lines.

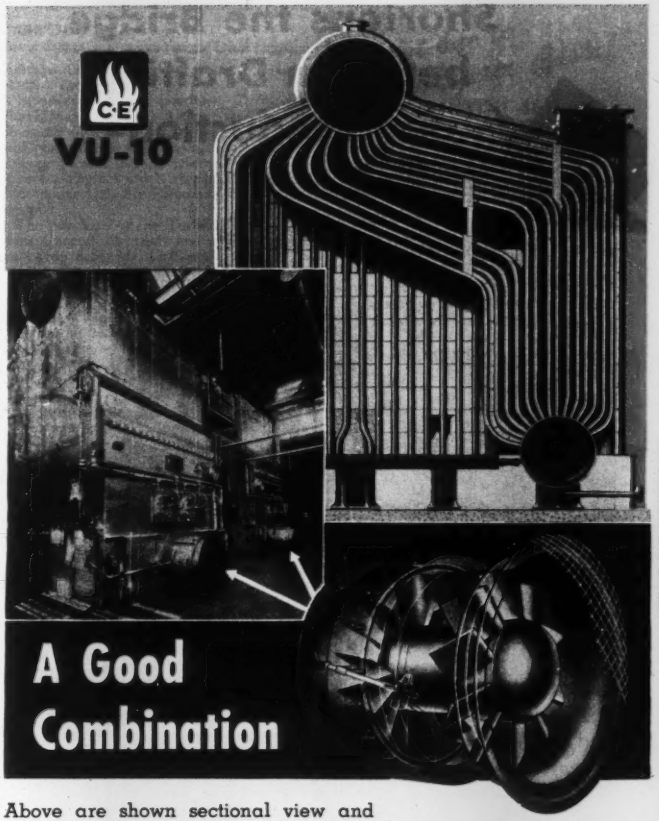
Link-Belt Motogear Drives Announced

Link-Belt Co. announces that it has developed a new packaged power unit, called Link-Belt Motogear, consisting of a compact, enclosed helical gear drive with separate standard motor, flexibly coupled and mounted on one welded steel base plate.

A movable plate between motor feet and welded base plate provides for convenient adjustment, should shaft realignment be necessary for any reason.

Link-Belt Motogears are built in a variety of sizes, in double or triple reductions, and in a wide range of ratios and horse powers. Input and output shafts are concentrically in line.

Continued on Page 60



Above are shown sectional view and actual installation of Combustion Engineering-Superheater's Vertical Unit Boiler Type VU-10. Installation shows two 27,000 lb. oil-fired units equipped with Wing Axial Flow Forced Draft Blowers. This integrated design of steam generator combines boiler, water-cooled furnace and fuel burning equipment in one soundly coordinated unit.

WING FORCED DRAFT BLOWERS are noted for:

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2. **Compact Design**
3. **Highest Efficiency**
4. **Quiet Performance**
5. **Built-in Voltrol Vanes** (capacity regulating and re-directing vanes)

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Canadian Factory: Montreal

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With Centralized One-Hand Control

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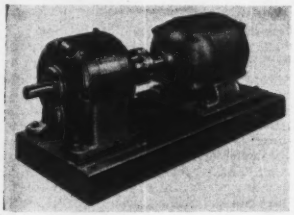
The Helical Gear Drive used on Motogears is like that employed in the corresponding Link-Belt Gearmotor but on the Motogear the motor is coupled to input shaft and mounted on a base plate instead of being integrally secured to side of drive.



The Helical Gear Drive is also available as a separate self-contained unit without the motor.

Complete information on Gearmotors, Motogears and separate Helical Gear Drives, 1 to 75 H.P., is given in a new 16-page Link-Belt Book No. 2247.

Scale Model Helps Sell Allis-Chalmers Substations

R. M. Casper (right), manager of Allis-Chalmers electrical department, and J. L. Singleton, vice president and director of sales of the company's general machinery division, study a one inch to one foot scale model of a typical SCS single circuit unit substation designed for use as a visual selling aid to supplement an intensive promotional campaign launched on the unit.

Equipment in the single circuit unit substation is functionally grouped and Mr. Casper points to one of a number of sales advantages—a single assembly unit which houses all switchgear components.

The SCS unit substation is used for providing 750 to 5000 kva at 2400 volts to 13,200 volts to utility and industrial loads. The model, built to clearly show the accessibility and flexibility of this particular unit substation, is made of wood, metal and plastic. It measures 18 inches high, $10^{3}/_{8}$ inches deep, $10^{1}/_{8}$ inches wide and weighs about 30 pounds.

Results of Valve Casting Tests

Extensive tests have indicated that nickel-chromium-molybdenum steel is very resistant to graphitization under conditions imposed by actual service in the field, and through laboratory studies of cast valves and fittings at steam temperatures up to 950° F, according to a technical paper by T. N. Armstrong and R. J. Greene presented by the latter at the annual meeting of the American Society of Mechanical Engineers in New York recently.

• Keep Informed . . .

The authors will relate that a cast steel valve of approximately WC-4 composition, which had been in service over six years, was made available for study through the co-operation of The Detroit Edison Co. Their paper will describe tests made on this valve and the results obtained.

Mr. Armstrong is in the Development and Research Division of The International Nickel Co., in New York, while Mr. Greene is with International Nickel's Research Laboratory, Bayonne, New Jersey.

Background Information on Babcock & Wilcox Co. Refractories Division

The Babcock & Wilcox Co. Refractories Division grew out of the idea that fire-brick could be engineered to meet the needs of modern furnaces. During World War I it became increasingly evident to executives of the Babcock & Wilcox Company that further progress in the development of larger and more economical boilers would be curtailed unless a superior refractory material could be found to line the furnaces of their boilers. Not finding such a refractory on the market, the Company instituted its own research program and developed B&W 80 Firebrick. This brick not only won quick acceptance in the boiler field but also found widespread use in many industrial furnaces where linings had to have unusual hot load strength, good volume stability, and high resistance to flame impingement and spalling. Later, the B&W 80 brick was supplemented by a companion firebrick, B&W Junior, to meet similar needs in intermediate duty furnaces. With the success of the firebrick established, the Babcock & Wilcox Refractories Division turned its attention to another problem which had been engaging the interest of industrial furnace builders: the problem of developing a firebrick which would combine the ability to withstand exposure to intense furnace heat with a high degree of insulating value. Such a brick would do away with the then prevailing construction of using a heavy, dense firebrick to withstand furnace heat plus a thick back-up insulation to confine heat to the furnace. In 1931 The Babcock & Wilcox Company produced the first commercially successful insulating firebrick, which have since had a profound effect on industrial furnace design and construction. During World War II, while supplying most of the firebrick and insulating firebrick for boilers on U. S. Naval and Merchant vessels, The Babcock & Wilcox Company Refractories Division began to map out a research program to meet the needs of industrial furnace designers and builders after the war. The first products to develop out of this post-war research program were a series of high temperature refractory castables. These are materials generally similar to ordinary building concrete but possessing unusual refractory properties which make them suitable for temperatures as high as 3000 F. The fact that these can be applied like ordinary concrete represents a substantial savings in construction and maintenance for many types of furnaces.

The research program for a mullite brick, leading to "Allmul," was also pushed with the knowledge that industrial furnaces were in need of a highly durable refractory that could be mass produced at economical prices.

General Electric Purchases Turbodyne Patents

The General Electric Co. has announced the purchase of the patents, name and technical data of the Turbodyne Corp. of Hawthorn, Cal., a Northrup Aircraft, Inc., research subsidiary which has developed a turboprop aircraft engine believed to be the most powerful propeller-type aircraft power plant in the world.

In announcing the purchase, C. W. LaPierre, manager of the Aircraft Gas Turbine Divisions of G.E.'s Apparatus Department, said that future work to be conducted on turboprops will include test and evaluation of several engines which were built by Turbodyne under U.S. Air Force and Navy sponsorship.

The purchase of the Turbodyne does not mark General Electric's first entry into the turboprop field, Mr. LaPierre stressed. He pointed out that the first turboprop to be designed and tested in this country, and the first to fly, was General Electric's TG-100. Work began on this engine before U. S. entry into World War II, tests were underway in 1943, and the first flight took place in December, 1945, in a Consolidated-Vultee XP-81.

After the initial flight tests of the turboprop, General Electric put main emphasis on the further refinement and production of the turbojet for high-speed military aircraft, deciding that development and improvement of gas turbine power plants, whether turboprop or turbojet, could best be achieved, for the time being, by concentrating efforts on the latter.

Mr. LaPierre said that in order to obtain additional types of information on turboprop engines, as a part of the company's broad work in the entire aircraft gas turbine field, the decision was made to make the Turbodyne purchase.

Last May, Northrup announced that a Turbodyne had successfully completed an official 50 hours endurance testing program,

Continued on Page 63

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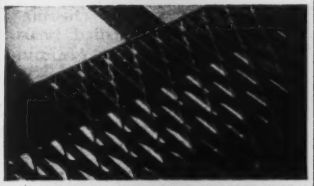

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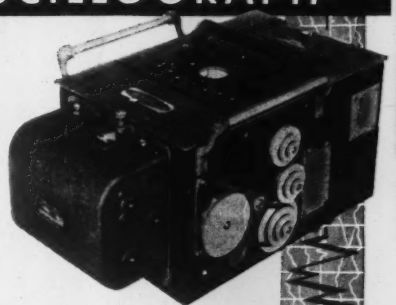

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- Continuous-drive magazine for records to 100 or 200 feet long.
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with the exclusive

SAFETY-VENT-SEAL

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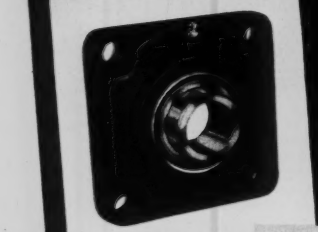
BOSTON Gear Self-Aligning Precision Ball Bearing PILLOW BLOCKS with SAFETY VENT SEAL



BOSTON Gear Self-Aligning Precision Ball Bearing FLANGED CARTRIDGES with SAFETY VENT SEAL

WRITE FOR BOSTON GEAR CATALOG NO. 55

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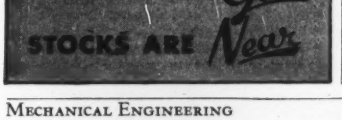
LOUISVILLE, KENTUCKY
Industrial Equip. Co.
7th & Myrtle Sts.
MEMPHIS, TENNESSEE
Lewis Sup. Co.
Main at Butler Sts.
MIAMI, FLORIDA
Gondos Corp.
2140-50 N. Miami Ave.
MILWAUKEE, WISCONSIN
Western Iron Stores Co.
319-331 East Clybourn St.
Wisconsin Bearing Co.
913-917 N. Market St.
MINNEAPOLIS, MINNESOTA
R. C. Duncan Co., 1300 4th St. S.
Minnesota Bearing Co.
1819 Hennepin Ave.
MONTREAL, QUEBEC
Renold-Coventry, Ltd.
1006 Mountain St.
NASHVILLE, TENNESSEE
Industrial Bearing Service, Inc.
411 Lafayette St.
NEWARK, NEW JERSEY
Squier, Schilling & Skiff
419 Plane St.
NEW ORLEANS, LOUISIANA
McClellan A-C Sup. Co.
2375 Tchoupitoulas St.
NEW YORK, NEW YORK
L. C. Bigiow & Co., Inc.
250 W. 54th St.
Boston Gear Works, 480 Canal St.
Frank Tracy, Inc., 202 Centre St.
OAKLAND, CALIFORNIA
Bearing Specialty Company
2503 Broadway
C. W. Marwedel
11th & Alice Sts.
PHILADELPHIA, PENNSYLVANIA
Bearings, Inc.
1410 W. Hunting Park Ave.
Boston Gear Works
Broad St. at Lycoming & 16th Sts.
Lindsay, Oberholtzer & Co.
4432 Ridge Ave.
Maddock & Company
42 N. Sixth St.
Pruyn Bearing Company
680 N. Broad St.
PITTSBURGH, PENNSYLVANIA
Somers, Fitler & Todd Co.
313-327 Water Street
PORTLAND, OREGON
Woodbury & Co.
133 S. W. 2nd Ave.
PROVIDENCE, RHODE ISLAND
Machine Parts Corp.
271 Washington St.
QUEBEC, QUEBEC
Renold-Coventry, Ltd.
5 Boutlamaque Ave.
QUINCY, MASSACHUSETTS
Boston Gear Works
14 Hayward St.
RICHMOND, VIRGINIA
Industrial Sup. Co.
15th & Franklin Sts.
ROCHESTER, NEW YORK
John N. Dietz Co.
110 Mill St.
ST. LOUIS, MISSOURI
Colonial Wright Mchy. & Sup. Co.
1223-1229 N. Broadway
SALT LAKE CITY, UTAH
Bearings Service & Supply Co.
68 W. Fourth South St.
SAN FRANCISCO, CALIFORNIA
Bearing Engineering Co.
1543 Mission St.
Boston Gear Works
123 10th St.
C. W. Marwedel
1235 Mission St.
SAN JOSE, CALIFORNIA
Masterson Bearing Co.
976 South First St.
SEATTLE, WASHINGTON
Cooper & Co.
932 First Ave. S.
SPRINGFIELD, MASSACHUSETTS
Boston Gear Works
29 Worthington St.
SYRACUSE, NEW YORK
Syracuse Sup. Co.
214 W. Fayette St.
TAMPA, FLORIDA
Southern Pump & Sup., Inc.
902 Twiggs St.
TOLEDO, OHIO
Ohio Belting & Trans. Co.
406 Orange St.
TORONTO, ONTARIO
Renold-Coventry, Ltd.
50 Edward St.
TRENTON, NEW JERSEY
Wiley Hughes Sup. Co.
801 New York Ave.
VANCOUVER, B. C.
Renold-Coventry, Ltd.
1066 Seymour St.
WATERBURY, CONNECTICUT
White Supply Co.
297 Thomaston Ave.
WILKES-BARRE, PENNSYLVANIA
Holmes Metallic Co.
519-521 S. Main St.
WINSTON-SALEM, NORTH CAROLINA
Keeler Brothers
300 E. 3rd St.
WORCESTER, MASSACHUSETTS
W. M. Steele Co.
171 Fremont St.



• Keep Informed . . .

fully qualifying the turboprop for preliminary flight tests. The company said that the engine had delivered more than 10,000 horsepower during the tests, and that it delivered 7500 horsepower continuously over long intervals of time.

The complete unit consisted of engine, reduction gears, propeller, and automatic electronic control system. The Turbodyne is designed for both pusher and tractor installation.

The Turbodyne drives a propeller and boosts with jet propulsion simultaneously. Air rams in a duct in the front of the engine and enters a compressor. The compressed air is whipped to combustion chambers, where it is united with fuel and burned intensely. This raises the temperature and velocity of the air and gases, which with great energy exert pressure on the buckets of the turbine wheel. The turbine is caused to spin at high speed, and through reduction gears drives the propeller. The gases passing through the turbine discharge rearward, producing a jet thrust.

• BUSINESS CHANGES

M. W. Kellogg Opens Canadian Piping Shop

Canadian Kellogg Ltd., has started operations in a new pipe fabricating shop in Edmonton, Alberta, it was announced recently by the parent company, The M. W. Kellogg Co., engineers and fabricators of New York and Jersey City. According to Kellogg, the shop was opened to service the rapidly expanding requirements for power and process piping in western Canada.

The shop, having an approximate monthly capacity of 400 tons, is equipped to fabricate not only carbon steel and low chrome piping, but also specialty materials such as stainless steel and high nickel alloys in a full range of pipe sizes. It is being operated by technicians and craftsmen specially trained in the advanced techniques employed by M. W. Kellogg for the production of the critical high temperature, high pressure alloy piping now being utilized by major American utility companies.

Purchase of R-S Products Corporation Announced

Purchase of the R-S Products Corp. of Philadelphia by S. Morgan Smith Company of York, Pa., hydraulic turbine and valve manufacturers, effective December 1, has been announced by Beauchamp E. Smith, president.

Although terms of the purchase were not disclosed, the Philadelphia concern reported that its annual sales have been substantially in excess of a million dollars. R-S Products Corporation currently has on its books an unfilled backlog of orders exceeding $1,250,000.

Mr. Smith announced that the present management of R-S Products Corporation, W. E. Borbonus, president, and D. W. Hopkins, executive vice president, will be retained along with the present five-man board of directors. The S. Morgan Smith Company will provide two additional members of the R-S board, Burwell B. Smith, vice president, and Duncan D. McArthur, secretary, respectively, of the parent company. There will be no change in the operation of the Philadelphia concern.

R-S manufactures butterfly valves which are widely used for controlling the flow of many types of fluids in process industries as well as in power plants and water supply systems. The combined operations of the two companies will permit sales of valves of all sizes. R-S also manufacturers large industrial heat treating furnaces. Mr. Smith stressed the importance of the merger to the national defense program. He observed that there is scarcely any vital war weapon which does not require the use of heat treating furnaces in its manufacture.

"Acquisition of R-S Products Corporation will greatly strengthen the productive capacities of both companies," Mr. Smith said. "The subsidiary company has been limited in its operations by the size of its manufacturing facilities. At the same time R-S Products Corporation's national sales coverage will greatly facilitate the distribution of certain Smith products." Officials of both companies called the transaction a logical and helpful merger for all concerned.

Appointment by Fitzgibbons Boiler Co.

Mills Engineering Co., Inc., 10 High Street, Boston, Mass., has been appointed to represent the Plate Products Division of the Fitzgibbons Boiler Co., Inc., in New England.

The Mills Engineering Co. has been serving industrial organizations and government agencies in a sales engineering capacity for twenty-four years and Benjamin Mills, Jr., President, a registered professional engineer with more than 30 years of mechanical engineering experience, has long been identified with steel plate fabrication.

This appointment by Fitzgibbons is in line with current expansion policies being carried out in steel plate fabricating through the company's Plate Products Division.

• LATEST CATALOGS

Mechanical Draft Fans Described in New Green Fuel Catalog

An extensive line of mechanical draft fans for both forced and induced draft service is described in a new catalog, known as Bulletin No. 168, issued by The Green Fuel Economizer Co., Inc., Beacon, N. Y. Containing 20 pages illustrated with drawings of typical fan types and photographs of representative installations, this two-color booklet also includes several performance curves showing efficiencies of various types of fans over a wide range of speed and delivery conditions. Also included are details of construction features, drive arrangements and mounting methods.

Data on Chemical Compositions of Seamless Alloy Steel Tubing

Babcock & Wilcox Tube Co. offers a new technical data card on the chemical compositions of the company's seamless alloy steel tubing, specifically B&W Croloy steels of the low and intermediate alloy groups. These apply to pipe for high-temperature service and tubing for use in heat exchangers, condensers, refinery stills, boilers and superheaters. Data covers carbon, manganese, phosphorus, sulphur, silicon, chromium and molybdenum content, according to ASTM specifications. The card, TDC 136, is available on request to Babcock & Wilcox Tube Co., Beaver Falls, Pa.

In addition to the seamless steel tubing of the low and intermediate B&W groups mentioned above, the company, with plants at Beaver Falls, Pa., and Alliance, Ohio, manufactures seamless alloy steel tubing for mechanical applications and seamless and welded carbon and stainless steel tubing for all pressure and mechanical end uses.

Continued on Page 64

When you design mechanical drives and controls...

... figure on S.S.WHITE flexible shafts

Just as a slide rule functions as a convenient, effective time-saver in solving mathematical problems, an S.S.White flexible shaft acts as an efficient, dependable shortcut in working out problems involving the transmission of rotary power and mechanical remote control.

The point is, you only need a single S.S.White flexible shaft to carry control or power between any two points. It can be run along contours, around corners, over obstacles over any distance.

Figure on using S.S.White flexible shafts for your drives and controls. Their basic simplicity and ready adaptability offer savings in time and money, simplified assembly and manufacturing operations, and completely dependable service. For details,

WRITE FOR NEW BULLETIN 5008

S.S.White MAKES IT RIGHT

It contains the latest information and data on flexible shafts and their application. Write for a copy today.

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DENTAL MFG. CO.
Dept. L, 10 East 40th St.
NEW YORK 16, N. Y.

• Keep Informed

Booklet Describes New Slipsyn Synchronous Motor Starters

A new eight-page booklet describing Slipsyn synchronous motor control, for the operation and protection of all types of synchronous motor drives, is available from Westinghouse Electric Corp. Photographs keyed to line drawings explain the operation of these starters and point out their features.

The new type ASR polarized slip-frequency field application relay is pictured and its operation is described. This relay can be adjusted on the job for best operating conditions under actual load.

The booklet also features a new pull-out relay which protects the motor in case it fails to synchronize, or in case it pulls out of synchronization after being in step.

For a copy of this booklet, B-4379, write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

New Booklet on Zeolite Softener for Small Plants

Cochrane Corp., 3142 North 17th St., Philadelphia, Pa., has just issued a bulletin on the Cochrane Junior Industrial Zeolite Softener, Publication #4505. This illustrates and describes a water softening apparatus for small boiler and industrial plants, laundries, hospitals, apartment houses, etc., where relatively small quantities of softened water (less than 100 gallons per minute) are required. Two groups of sizes are offered, each group available is single or double units with greensand, synthetic gel and resinous type zeolite material according to the requirements of the water supplies. Drawings, dimensions and capacities are shown.

New Folder on Insurok Plastics Offered by the Richardson Co.

A new four-page brochure, entitled "Insurok Molded and Laminated Plastics," has just been published by The Richardson Company, plastics molders and laminators.

Attractively printed in two colors, the new publication describes the wide line of "Insurok" laminated and molded plastics products, and outlines the company's production facilities and plastics engineering services.

The page on laminated "Insurok" includes a description of available forms, fabricated parts, gear stock, bearings, and post-formed laminates.

Molded "Insurok" products are discussed as to types of material, fillers, and methods of production possible at The Richardson Company. The company's broad range of technical services—covering research, design, and production in plastics—is also described.

Copies of the new brochure may be obtained by writing The Richardson Company, 2762 Lake St., Melrose Park, Ill.

New Allis-Chalmers Induction Motors Bulletin

Construction features of Allis-Chalmers large two-pole squirrel cage induction motors are given in a new bulletin released by the company.

A cross section view of a typical normal torque, low starting current motor shows the construction of stator winding, bearings, ventilation, squirrel cage winding, rotor, stator, and bearing brackets. This is supplemented by additional photographs of motors and motor parts.

The construction features described in the bulletin are available in Allis-Chalmers standard 40 C rise continuous rated, two-pole, 60-cycle, 3,600-rpm, bracket-bearing, squirrel cage motors for direct-connected drives in all ratings 900 horsepower and larger.

If your plant requires

- DIRECT HEATING OF VAPORS
- DIRECT HEATING OF LIQUIDS
- DOWTHERM INDIRECT HEATING
- STEAM GENERATORS
- STEAM SUPERHEATERS
- WASTE HEAT BOILERS

place the selection of the specific type in specialized hands . . . and obtain optimum efficiency.

Petro-Chem Development Company engineers are heating specialists . . . they can supply the whys and wherefores of indirect versus direct heating and the economics of both.

Every day more than 600, oil and gas fired, Petro-Chem Iso-Flow* installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation.

***Patents issued and pending**

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Representatives:
Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster Pittsburgh • Faville-Levally, Chicago • Lester Oberholz, Calif.

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These motors are built for boiler feed pumps, oil pipeline pumps, centrifugal blowers, descaling pumps, and other high speed drives.

Copies of the bulletin, 05B7550, are available upon request from Allis-Chalmers Manufacturing Company, 949 S. 70th Street, Milwaukee, Wisconsin.

New Bulletin Issued on Kel-F Dispersions

A new Technical Bulletin (No. 4-10-50) containing information on the properties and methods of applying Kel-F (trifluorochloroethylene thermoplastic) dispersions has just been issued by the Chemical Manufacturing Division of The M. W. Kellogg Co., refinery and chemical engineers of Jersey City, New Jersey.

Giving detailed data on the characteristics of this new product, the bulletin points out that Kel-F dispersions may be applied by spraying, dipping or brushing. This bulletin describes means for applying these dispersions; includes properties of the first two of a series, and suggests fusion operations.

At the same time, Kellogg announces that it has revised Technical Bulletins No. 2 and 3 which include data on the modification of Kel-F properties resulting from heat treatment and molding techniques respectively.

Clark Issues Booklet on Powered Hand Trucks

The new powered hand trucks recently announced by the Clark Equipment Co. are described in detail in a 12-page, two-color booklet just off the press.

Separate sections of the book are devoted to each of the two power types: the Electro-Lift, battery-powered and motor driven; and the Hydro-Lift, gas-powered and driven by hydraulic pump and hydraulic motor.

The center-spread provides data concerning the mounting of the drive motors—both electric and hydraulic—inside the drive wheel; turning radius; the frame and other major units common to both power types and other important features.

A copy of the booklet is available upon request to the Clark Equipment Co., Industrial Truck Division, Battle Creek, Michigan.

New Catalog Describes Condenser Circulators

Condenser circulators, in standard sizes to 100,000 G.P.M., and in special sizes to 200,000 G.P.M. are illustrated and described in a new Catalog No. G-1050, just issued by Economy Pumps, Inc., Div. of Hamilton-Thomas Corp., Hamilton, Ohio.

Designed for power station service, the pumps described are vertical, mixed-flow units of large capacity and low head. Simple in design and compact in construction, they are capable of handling larger volumes of water at lower cost than any other type of efficient pumping equipment.

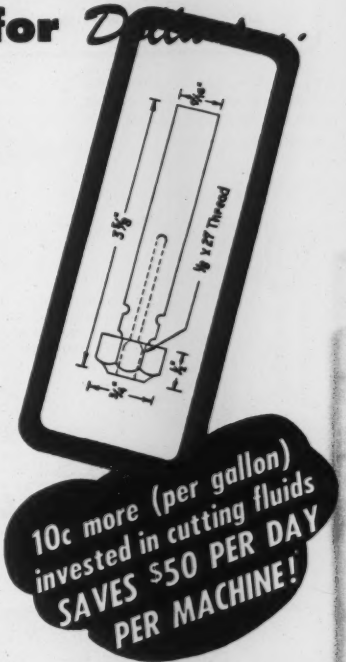
According to the manufacturer's catalog, Economy Condenser Circulators of various special metals will handle water of every type chemical analysis, from fresh river water to contaminated harbor or sea water.

New "pull-out" type units are also illustrated in the catalog. These units permit removal of all operating parts without pulling out the complete pump or disturbing pipe connections.

A copy of Catalog No. G-1050, "Circulators by Economy," may be obtained by writing the manufacturer, Economy Pumps, Inc., Div. of Hamilton-Thomas Corp., Hamilton, Ohio.

Continued on Page 68

How to trade *Pennies* for D[illegible]



10c more (per gallon) invested in cutting fluids SAVES $50 PER DAY PER MACHINE!

PRICE alone makes no profit. The drawing above illustrates a shackle bolt which is drilled and tapped on a New Britain Automatic. Using an inferior cutting oil 12 taps were used up every 2½ days—12 pieces per tap. A change to Stuart's SPEEDKUT M on a 2½ day run showed 530 pieces per tap—no taps used up. The saving? Taking into full account the pennies—higher price of Stuart *quality* oil: $50 per day per machine!

If you are interested in a saving like this, ask to have a Stuart representative call. There is no obligation—we'll let Stuart performance do the selling.

Send for your copy of
"CUTTING FLUID FACTS"
Stuart's booklet of cutting fluid data.

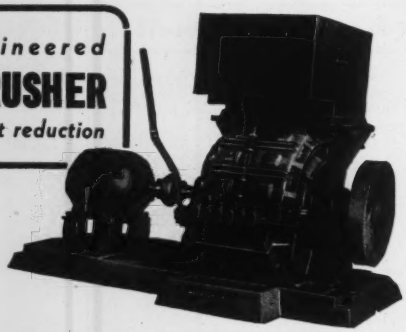
D. A. Stuart Oil CO.

2741 S. Troy Street, Chicago 23, Illinois

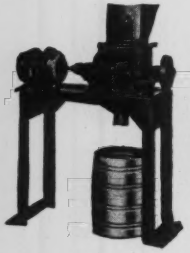
There's a job-engineered

AMERICAN CRUSHER

for uniform . . . low-cost reduction



. . of COAL, CLAYS, CHEMICALS, STONE, METAL TURNINGS, WOOD, DRY ICE, FOOD—hundreds of products of every description.



Metal Turnings Crusher—reduces long, curly turnings of steel, alloys, brass, aluminum, etc., to uniform chips for highest cutting oil recovery . . . increased scrap value.

Laboratory Mill—for testing, pilot plant operation and waste reduction.

"AC" Ring Mill—with exclusive shredder rings—for uniform, high tonnage reduction. 500 TPH. "24 Series" ring or hammer crushers offer capacities to 50 TPH. . . . "30 Series" Hammermills to 100 TPH.

Write for complete information on the famous American line of crushers.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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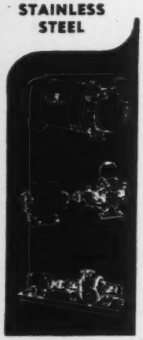
Better on "1001" Pumping Duties

Capacities to 150 G.P.M. Heads to 500 Ft.

WE STOCK APCOS IN STAINLESS STEEL



APCO Two-Stage Turbine Type Pump for High Pressure Service

Apco—the pump with but one moving part, the impeller — is famous for long-lived, efficient performance on small capacity, high head duties. Available in Single Stage, Two Stage and 4-Stage Tandem for high pressures — and Water Jacketed for high temperature and highly volatile liquids.

Write for Bulletins 111, 111-A, 111-WJ

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Centrifugal Pump Guide

Economical pumping units for every industry are catalogued in a new 16-page "Handy Guide to Selection of Centrifugal Pumps" released by Allis-Chalmers Manufacturing Co.

A wide variety of units are indexed in this bulletin including close-coupled, pedestal, double suction single stage, multi-stage, self-priming, fractional horsepower, coolant and circulating, fire, process, solids handling, marine, rubber-lined, paper pulp, sewage, axial and mixed flow pumps.

Head capacity charts and tables for various types of the pumps are given along with data on sizes, capacities and construction features.

Copies of "Handy Guide to Selection of Centrifugal Pumps," bulletin 52B6059G, are available upon request from Allis-Chalmers Manufacturing Co., 949 S. 70th., Milwaukee, Wisconsin.

New Catalog Issued by Atlantic Metal Hose Co.

Catalog 500 on flexible metal hose which has just been issued by the Atlantic Metal Hose Co., 123 West 64th Street, New York 23, New York, should prove a valuable working tool in design and maintenance departments since it contains the latest data compiled by the company's engineers.

David M. Fuchs, head of the sales department, states that Catalog 500 employs a new method of compartmentalizing data so that cross-references and foot-notes are completely eliminated. Design and maintenance engineers, and all those using and supplying flexible metal hose can secure complete application and construction data without loss of time.

Section one includes flexible metal interlocking high pressure hose, air jacketed hose for diesel exhausts, and conveyor hose for ventilating and exhausting. The second section refers to flexible metal seamless high pressure hose and diesel exhaust hose. Section three is concerned with metal lined gasoline hose and synthetic rubber gasoline hose. Couplings applicable to the various hose comprise the last section.

Of great value are the U. S. Navy Department test table for bronze and steel hose; data on bending diameters, hydrostatic bursting pressures, and the series of installation diagrams.

Inquiries concerning Catalog 500 should be addressed to Mr. David M. Fuchs at the Atlantic Metal Hose Co.

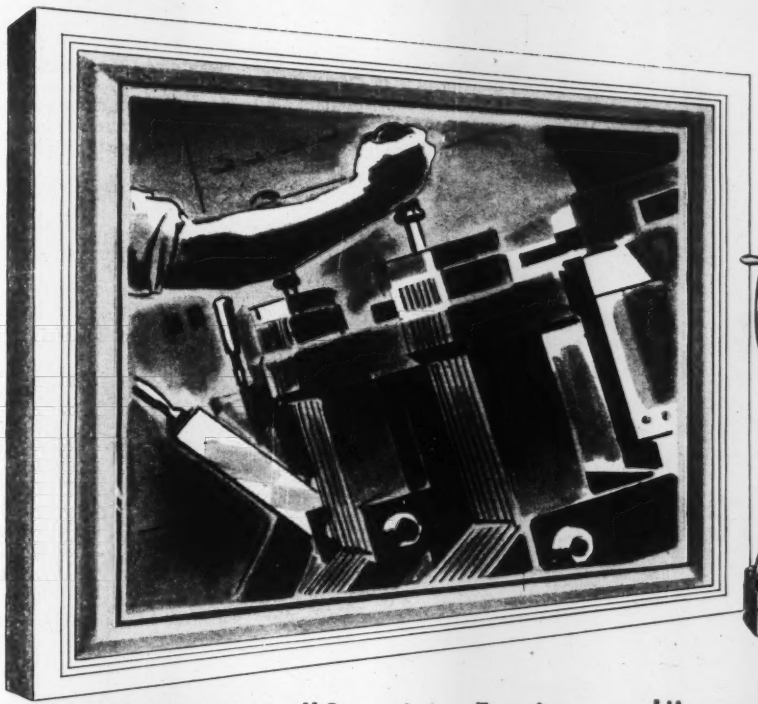
S.S. White Publishes New Bulletin on Flexible Shafts

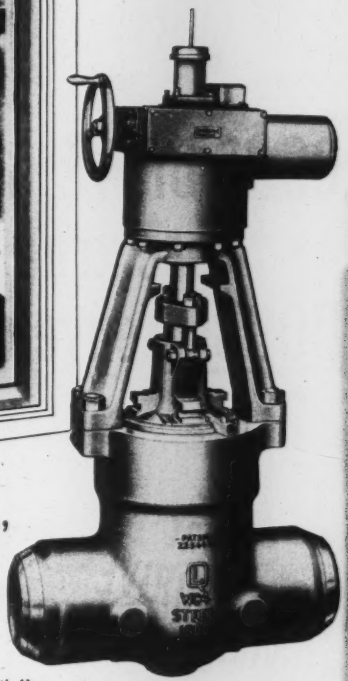
A new 12-page booklet, Bulletin 5008, outlining the basic principles of flexible shaft selection and application, has been issued by the S.S. White Dental Manufacturing Co. The bulletin includes the latest developments in flexible shafting and is fully illustrated with drawings, photographs and tables showing construction details and performance data of both power drive and remote control types. Instructions are given on how to select flexible shafts for specific applications.

Also included is a description of the variety of sizes and types of flexible casings available for use with S.S. White flexible shafts. These include metallic, fabric, rubber and plastic covered casings.

An interesting feature is a list of Flexible Shaft Do's and Dont's, based on S.S. White's more than 70 years' experience in the design, manufacture and application of flexible shafting.

Free copies can be obtained by writing The S.S. White Industrial Division, 10 East 40th Street, New York 16, N. Y.





LUNKENHEIMER "Service-Engineered" Steel Valves Will Meet YOUR SPECIFIC APPLICATION PROBLEMS

MAINTENANCE costs need specialized attention, these days—especially in the power field, where steel valves are vitally important. There's no cure-all for your valve maintenance problem. It has to be tackled an installation at a time — service by service — and that's where Lunkenheimer engineering comes in.

Lunkenheimer breech-lock valves are your insurance against excessive valve maintenance. Gaskets, rings, flanges, and bolting, all of which tend to induce leakage because of their instability at high pressures and temperatures, have been eliminated. Bodies and bonnets are locked securely together by intermeshing lugs that carry the full internal pressure. Maintenance of the joint is never required, and pressure tightness is unaffected by high pressures, high temperatures, sudden quenches, or creep. It's simplicity itself — an exclusive, patented design, developed by Lunkenheimer to eliminate any possibility of bonnet-joint leakage. Call in the Lunkenheimer representative in your area. He'll be glad to put at your command all the generations of successful experience behind Lunkenheimer's complete selection of "service-engineered" steel valves. For his address, write The Lunkenheimer Co., P. O. Box 360E, Cincinnati 14, Ohio.

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THE ONE *Great* NAME IN VALVES

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Why DOUBLE enveloping gears?

For over 150 years, gear men have recognized that double-enveloping gearing—IF IT COULD BE PRODUCED—would mean more teeth in contact, more contact per tooth, greater load carrying capacity, smoother operation. But it was not until Samuel I. Cone developed a rational production method that true double-enveloping gears became possible.

CONE-DRIVE GEARS are true DOUBLE-enveloping

What CONE-DRIVE double-enveloping gears mean to the user

1. **Greater Load Carrying Capacity,** since
   - ALL engaged teeth are in CONTINUOUS CONTACT
   - EACH tooth is in contact FULL DEPTH and for a substantial portion of its width
2. **Smaller Gears Can Be Used,** since
   - Load carrying capacity is greater
   - Strength is higher
   - Unit pressures are lower
3. **Gears Are Stronger,** since
   - Load is distributed over all teeth in engagement
   - Teeth are in "shear" only
   - Tooth thickness can be varied between a gear and pinion of different materials to balance stresses
4. **Gear Design Is Simplified,** since
   - Ratio, number and size of teeth do not affect capacity or tooth strength
   - Pressure angle is fixed, circular pitch does not have to be considered
5. **"Hydraulically-smooth" Drive Is Obtained,** since
   - Contact is continuous and velocity constant
   - Regardless of the number of teeth in the gear, a full 1/8 of the teeth are simultaneously in contact

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Division Michigan Tool Company
DOUBLE ENVELOPING GEAR SETS & SPEED REDUCERS
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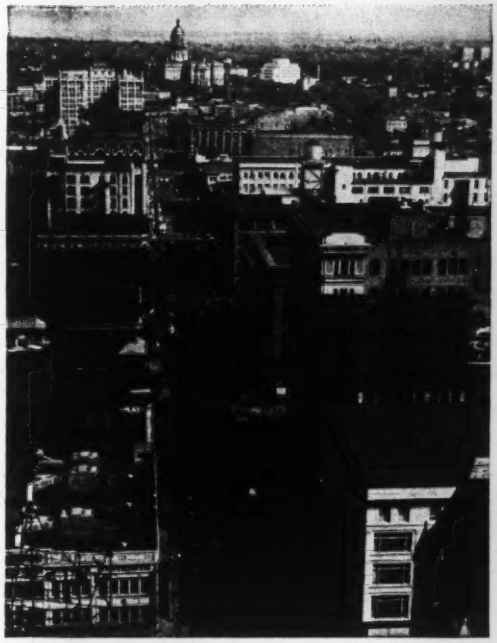
American Blower—a time-honored name in air handling



In Denver, as in other cities, American Blower Air Handling Products serve commerce, industry and public utilities. For air handling data in the Denver area, call American Blower —Main 3179. In other cities, consult your phone book.

Look before you buy. Comparison tests prove the superiority of American Blower Products. There's a big difference in quality, design, quietness, operating costs and efficiency between American Blower and other air handling equipment.

Air is free . . . use it profitably!

THERE *is* a big difference in air handling equipment.

Quality of workmanship, performance and cost of operation, as well as the experience and integrity of the manufacturer. These are all important factors to consider when buying equipment for handling air.

Take fan ratings, for example. All American Blower Air Handling Equipment is tested and rated in accordance with the Standard Test Code as adopted jointly by the N.A.F.M. and the American Society of Heating and Ventilating Engineers. All ratings are Certified.

These tests are being made continuously in our laboratories built exclusively for this purpose and containing every modern type of equipment for research and testing.

To buyers of air handling equipment, whether it be power plant equipment—mechanical draft fans, fly ash precipitators, Gyrol Fluid Drives for fan control and boiler feed pumps, or air handling equipment for any need—these plus values insure longer, more dependable service and lower operating costs.

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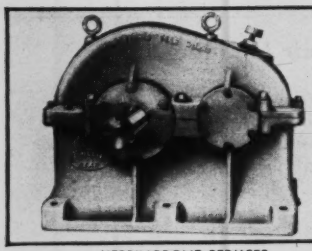

HERRINGBONE REDUCER

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SPEED REDUCERS

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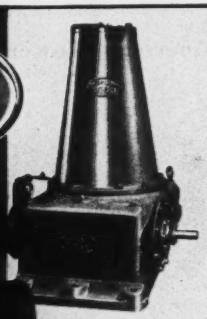
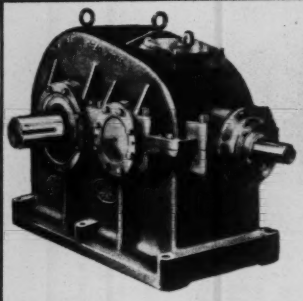
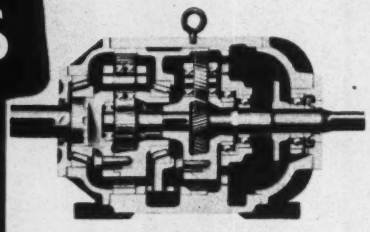


Steeple Type WORM REDUCER

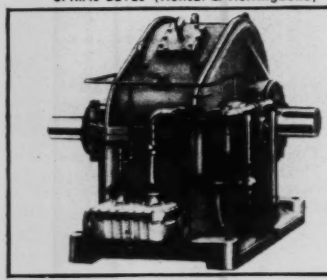
VERTICAL MotoReduceR (With Planetorque)



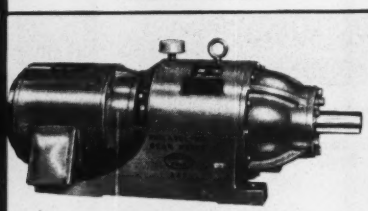
SPIRAL BEVEL (Helical & Herringbone)



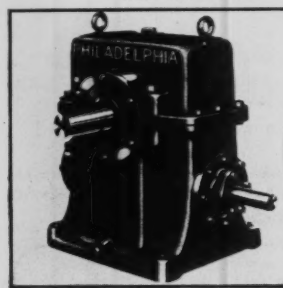
PLANETARY REDUCER



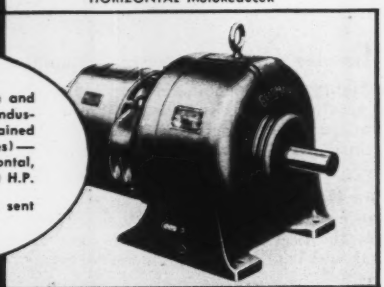
SPEED INCREASER



HORIZONTAL MotoReduceR



WORM GEAR REDUCER



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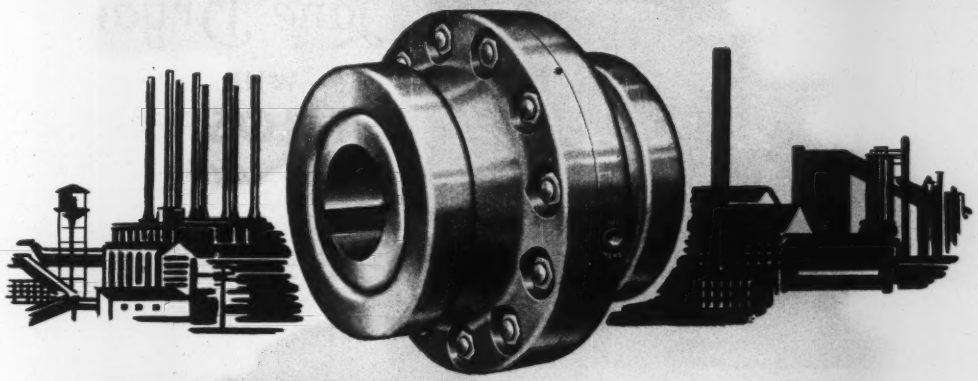

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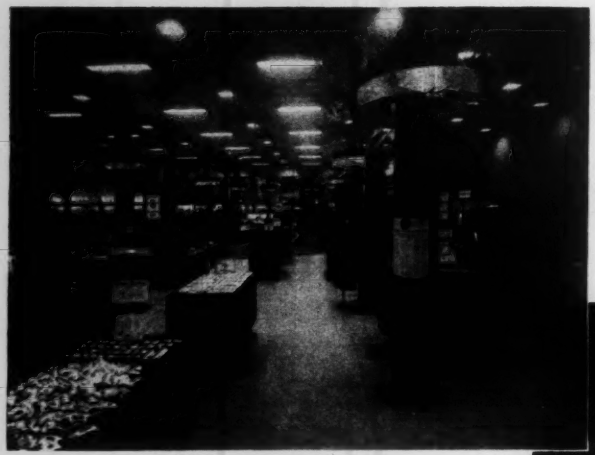
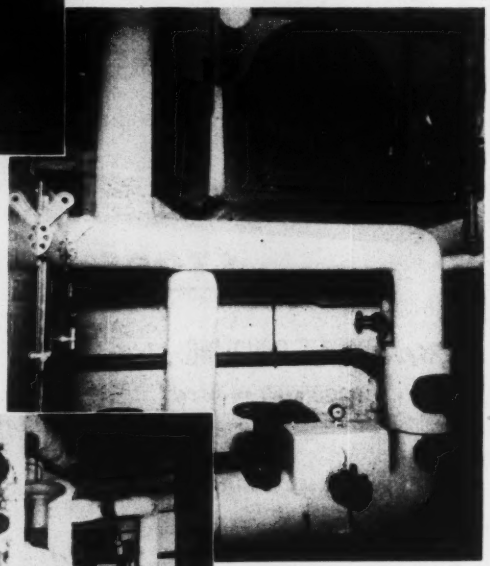


Lane Bryant

—WHERE THE "ATMOSPHERE" IS ALWAYS RIGHT!



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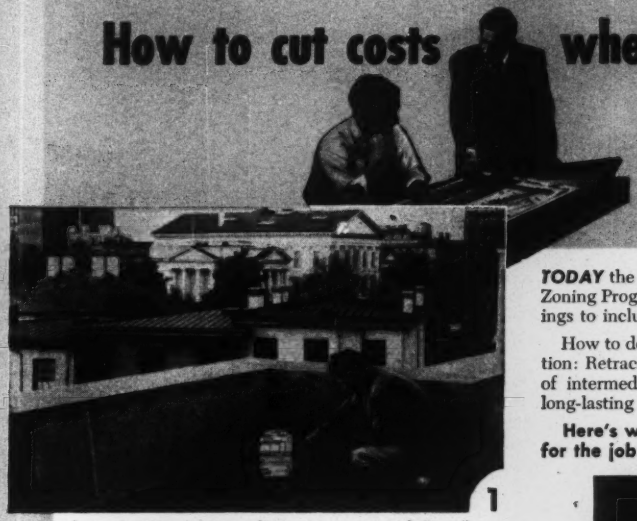
How to cut costs when drafting revisions are necessary

* A case history based on the experience of the Virginia Department of Highways



1

Long-lasting intermediates are assured. In a "permanence test" made by the Virginia Dept. of Highways, an Autopositive print was left on a roof top for 36 days. During this time this photographic intermediate was exposed to 200 hours of sunlight . . . 6.88 inches of rain. Despite all of this abuse it was declared "good as new."

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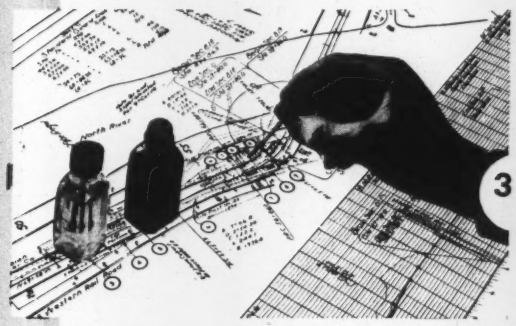

3

TODAY the State of Virginia is engaged in a long-range Highway Zoning Program which necessitates changing thousands of drawings to include proposed right of ways.

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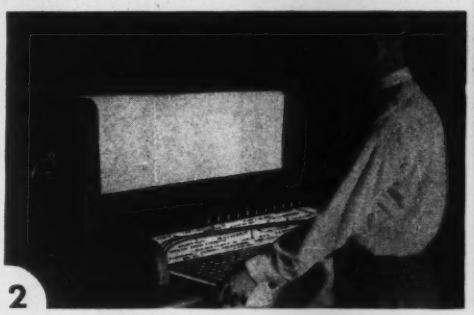

2

Photographic intermediates are produced at a new low cost. When "Autopositive" is used, positive photographic intermediates are produced *directly* without a negative step, without darkroom handling. Maximum efficiency is realized by the Virginia Dept. of Highways because its "Autopositives" are turned out automatically . . . in a continuous blueprint machine, which can be converted readily for Autopositive production.

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Kodagraph Autopositive Paper

"The Big New Plus" in engineering drawing reproduction

16

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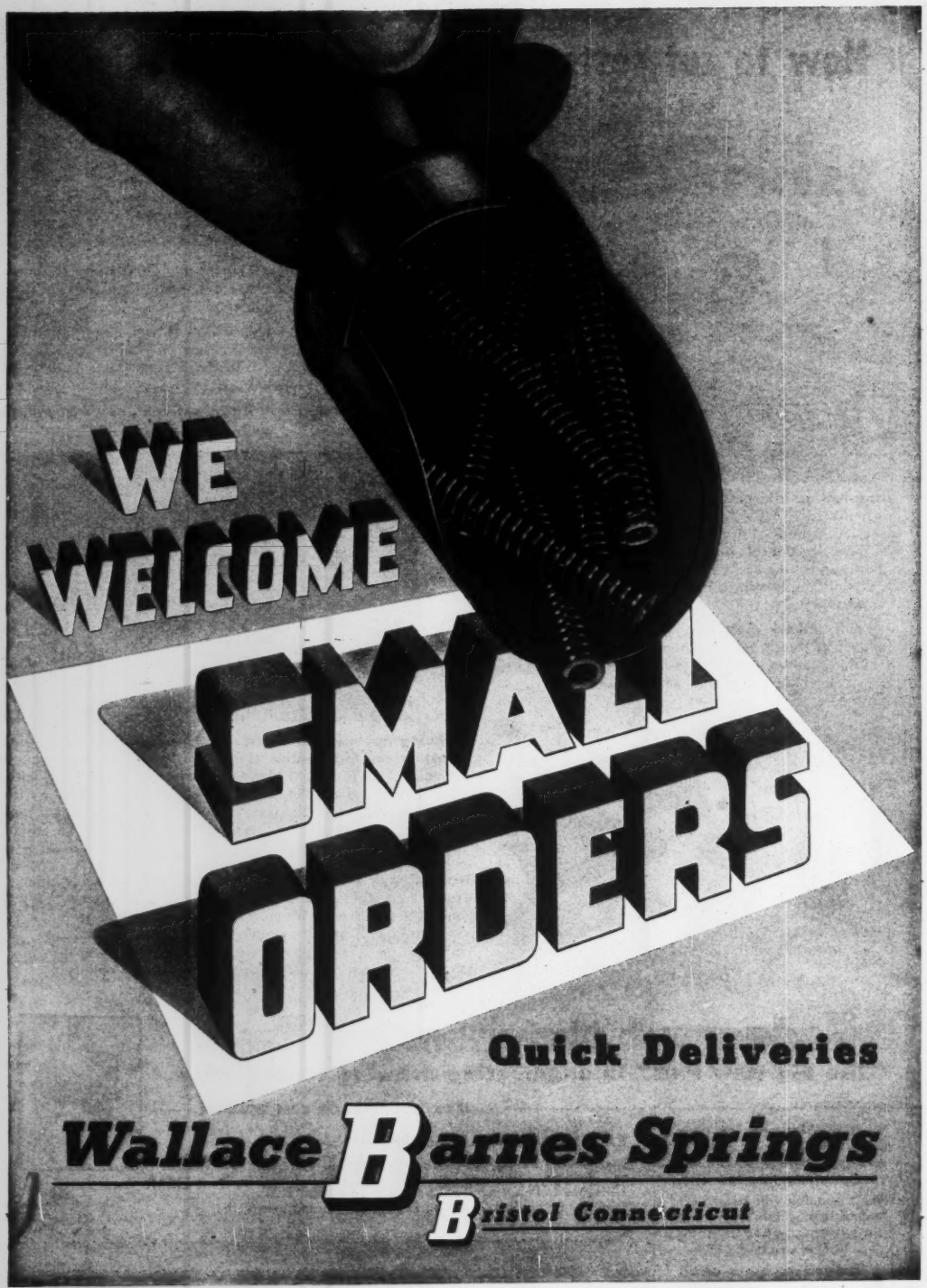
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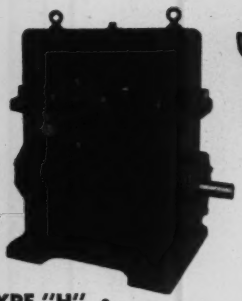

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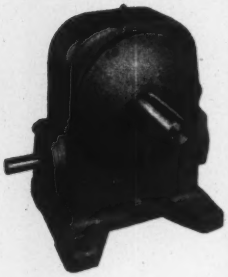

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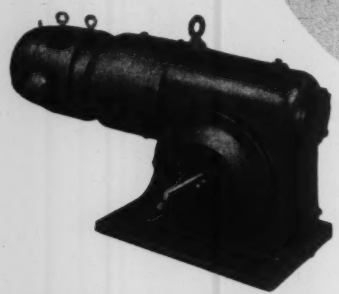

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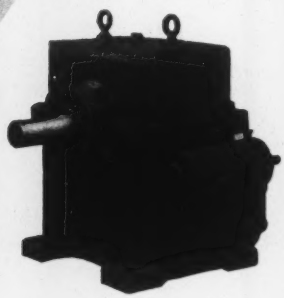

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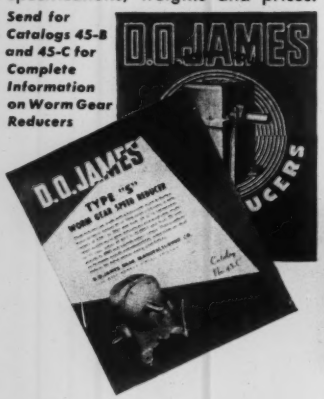

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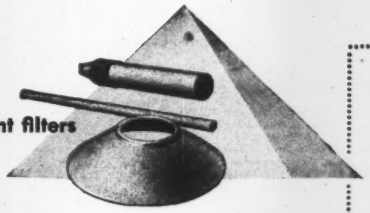

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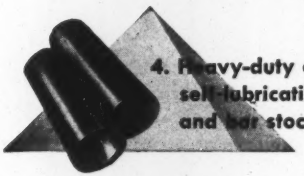

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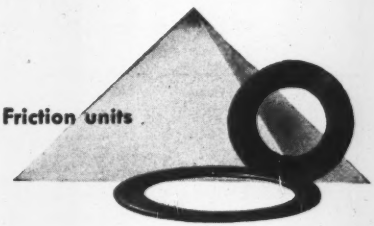

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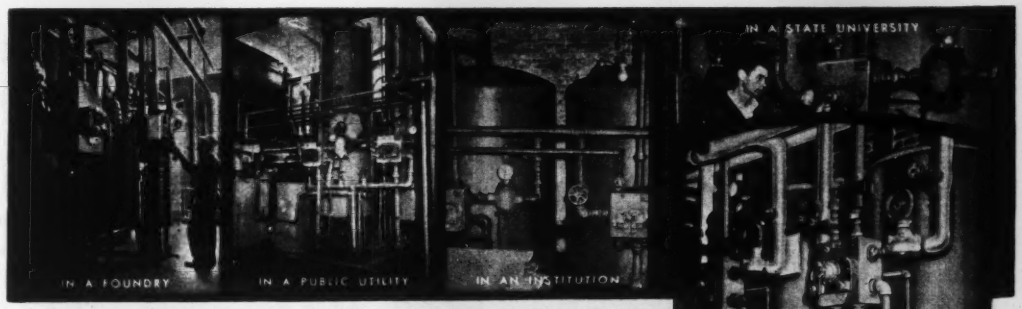

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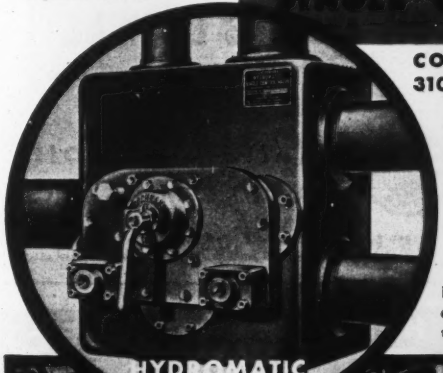

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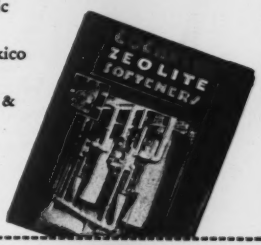

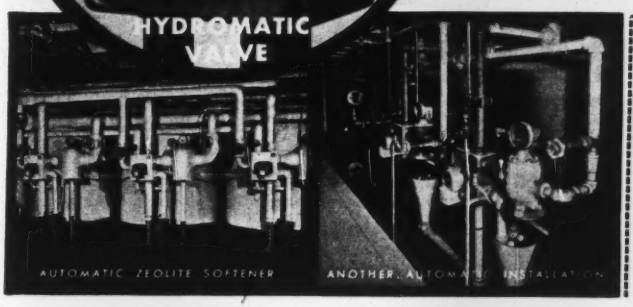

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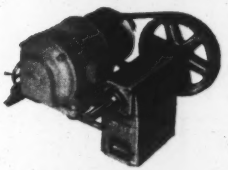

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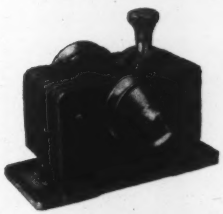

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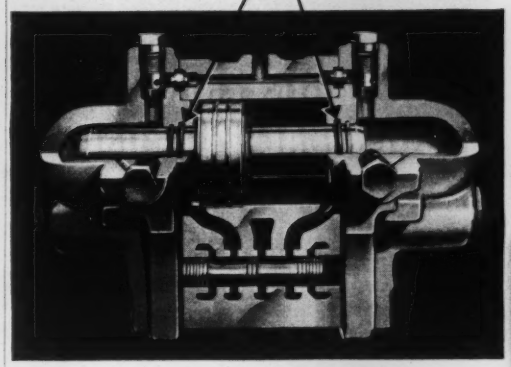

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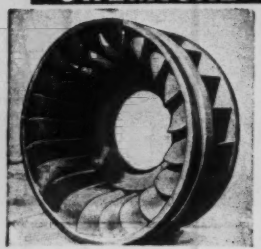

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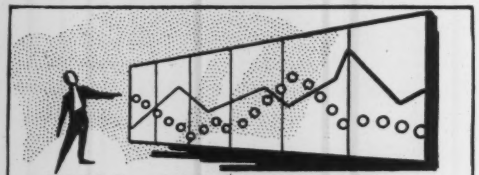

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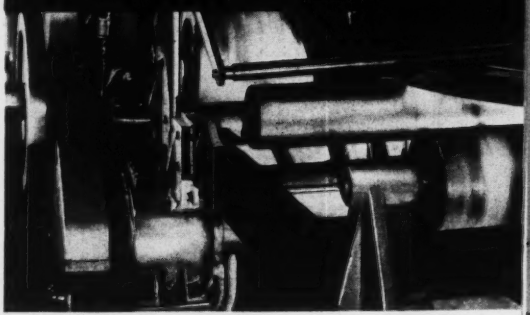
AND CUT-OFF



UPPER—Oilgear 40 hp Variable Speed Drive with electric pilot motor remote control and oil reservoir base.

LOWER—Oilgear 7½ hp Variable Speed Drive with automatic control to synchronize cutter speed with speed of laminating machine drive.

Oilgear

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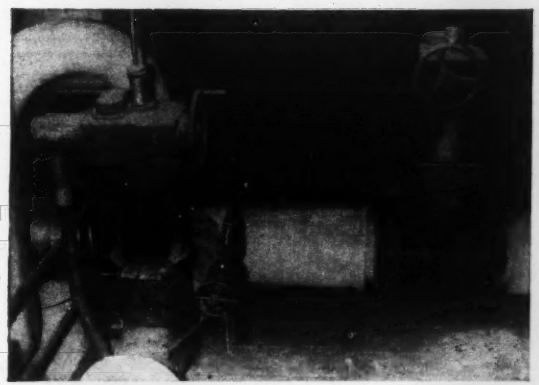
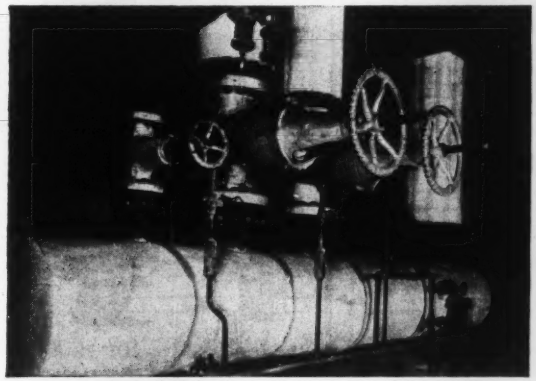
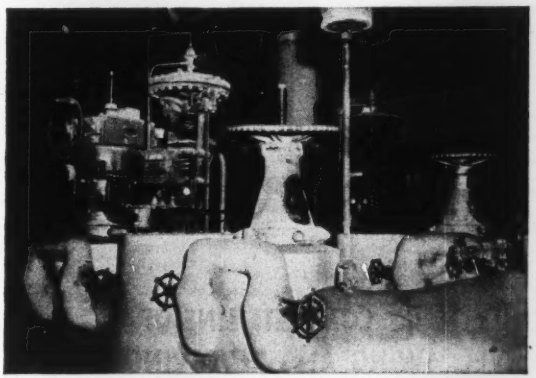


Walworth Motor Operated Series 900 Pressure-Seal Cast Steel Gate Valves.



Walworth Series 600 Pressure-Seal Cast Steel Gate Valves.



Manually operated and motor operated Walworth Series 900 Pressure-Seal Cast Steel Gate Valves.

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CAST STEEL VALVES

The bonnet and body design of Walworth Pressure-Seal Valves is such that the pressure within the valve is used to prevent leakage at the junction of the bonnet and body. Sudden temperature and pressure changes do not affect this tightness. Bonnet flanges and studs are eliminated and the weight of the valve is reduced.

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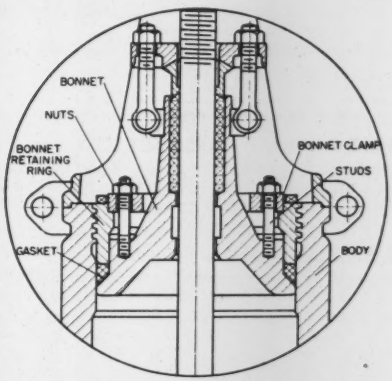

A cross section of the bonnet joint assembly of a Walworth Pressure-Seal Cast Steel Gate Valve. The internal pressure is utilized to make the body-to-bonnet joint tight.

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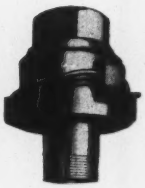
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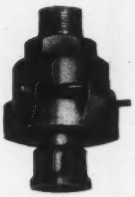
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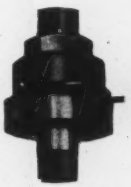
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Continued on Page 88

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Five Pages of "OPPORTUNITIES" This Month . . . 87-91

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Continued from Page 90

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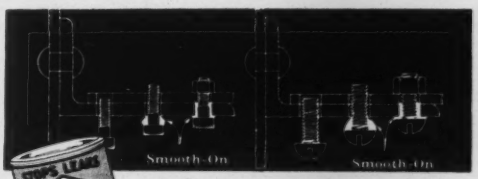

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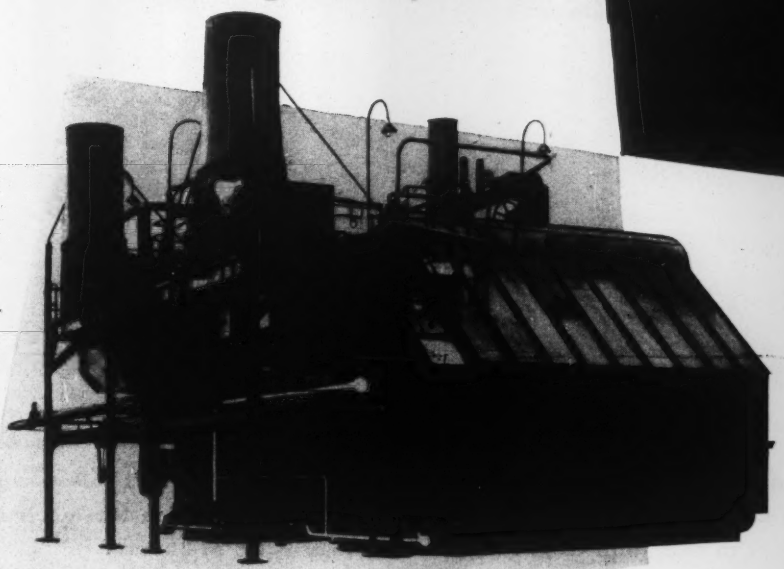
WICKES STEAM GENERATORS

at work in new Texas natural gasoline plant . . .



The *Wickes* Type A Steam Generator is proving itself one of the most serviceable boiler units employed by the oil and gas industry. These units, recently installed at a new Texas plant, each generate 80,000 pounds of steam per hour. The efficiency and ease of installation make the Type A boiler especially suited to the industry. *Wickes* can fill your exact requirements for boilers of any type up to 250,000 lbs. steam per hour and 850 p.s.i.

Wickes service facilities are world-wide and our knowledge of steam generation is available to you without obligation. Write for descriptive literature on the famous *Wickes* line of steam generators.

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THE WICKES BOILER CO. • SAGINAW, MICHIGAN

Division of The Wickes Corporation • Recognized Quality Since 1854

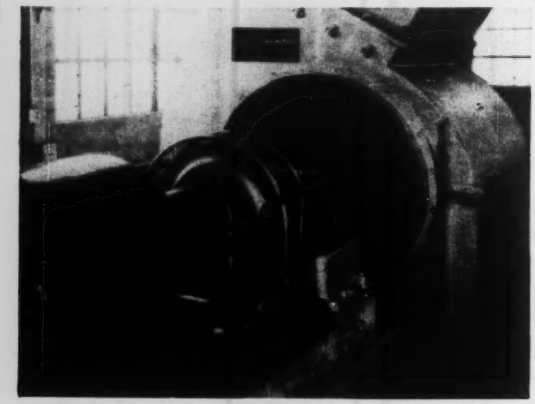
SALES OFFICES: Atlanta • Boston • Chicago • Cincinnati • Denver • Detroit • Houston Indianapolis • Los Angeles • Milwaukee • New York City • Pittsburgh • Saginaw San Francisco • San Jose • Springfield • Seattle • St. Louis • Tulsa • Mexico City Buenos Aires • Manila • Havana • Montevideo • San Juan, P. R. • Victoria, B. C.

Consumers Power *Again* Selects

CLARAGE FANS

. . . for Both Forced and Induced Draft

Built in 1940 — enlarged to practically twice capacity in 1949 — and *both times* Clarage HEAVY-DUTY equipment was chosen for mechanical draft in this John C. Weadock plant, Bay City, Michigan.



One of the four Clarage forced draft fans; each 100,000 c.f.m. at 12" S.P. There are also two Clarage induced draft fans included in this latest Weadock power plant installation; each with a capacity of 330,000 c.f.m. at 17" S.P., 350° F.

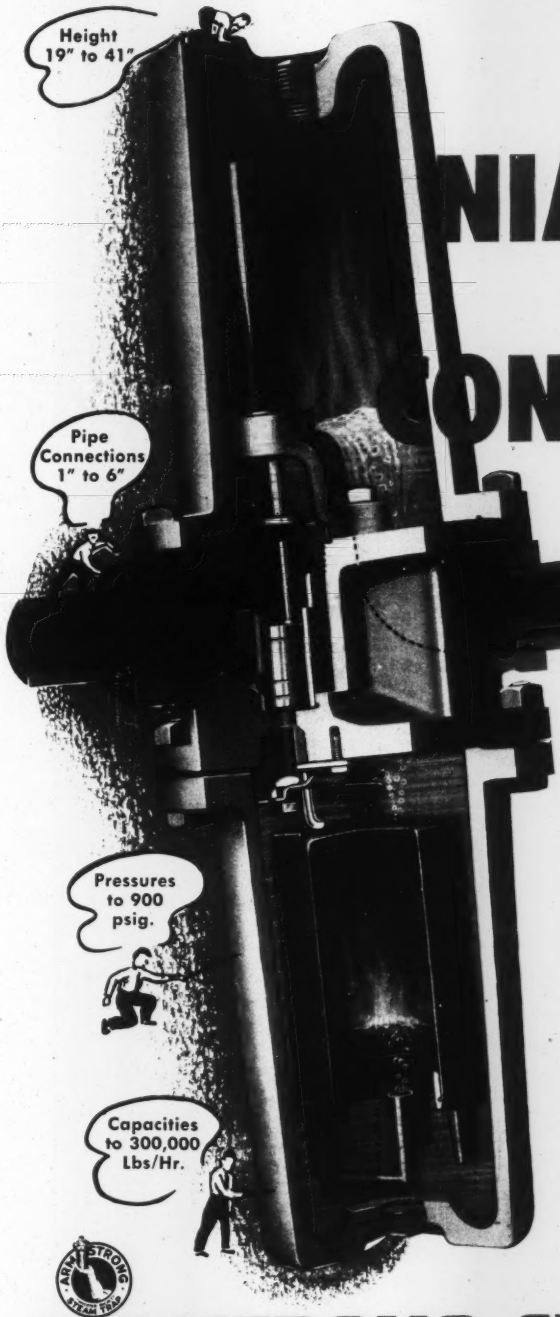
All told, Consumers Power Company has had 24 years of experience with Clarage forced and induced draft fans. Other installations include: East Ave. Station, Kalamazoo (1926); Elm St. Station, Battle Creek (1938); Bryce C. Morrow Station, Comstock, Michigan (1939).

Specialists in this exacting field of mechanical draft, we have facilities to meet all requirements. To date over 3,000 power plants are Clarage equipped. If you are looking for the *best in performance* and *dependability*, it will pay you to consult with us.

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

CLARAGE
—HEADQUARTERS for Air Handling and Conditioning Equipment

Sales Engineering Offices in All Principal Cities



NIAGARAS of CONDENSATE

can be handled with ARMSTRONG *Compound* STEAM TRAPS

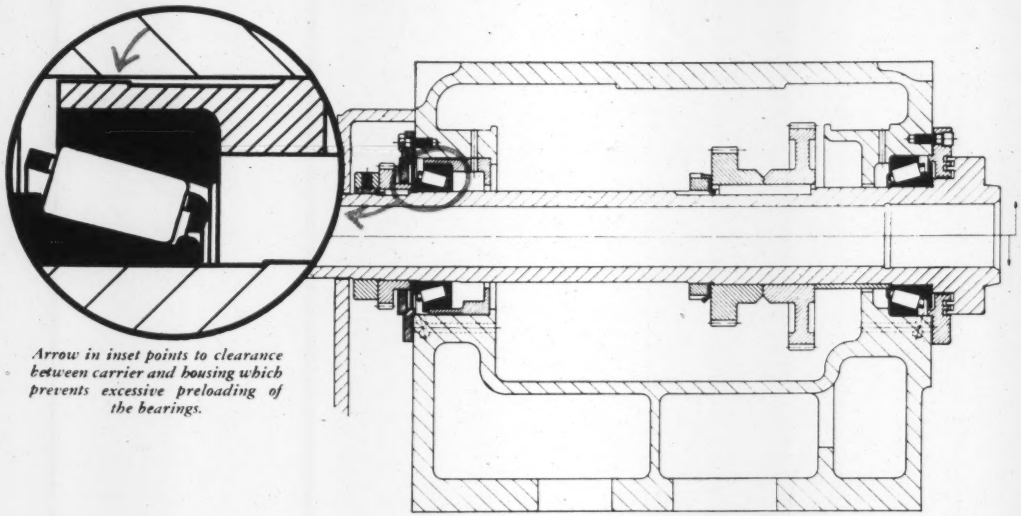
WHERE there is a lot of condensate to handle in a hurry, Armstrong Compound Steam Traps fill the bill to perfection. They will take sudden as well as normal loads in stride — give you dependable, automatic drainage of purifiers, separators, de-superheaters, flash tanks, headers, hot water heaters, continuous blowdown systems and process equipment.

In these traps a standard Armstrong inverted bucket trap mechanism actuates a piston-operated discharge valve with a much larger orifice than could possibly be considered in an ordinary trap. The result is a thoroughly dependable trap which is surprisingly small and compact in relation to its capacity. For full details call your Armstrong representative or write: ARMSTRONG MACHINE WORKS 94 Maple Street, Three Rivers, Michigan.

●*THE ARMSTRONG STEAM TRAP BOOK includes essential data on Compound Traps as well as traps for general service. You are welcome to a copy — no obligation. Write today.*

ARMSTRONG STEAM TRAPS

Greater accuracy for high-speed spindles...with TIMKEN® bearings in new, semi-flexible mounting



Arrow in inset points to clearance between carrier and housing which prevents excessive preloading of the bearings.

NOW the way is open for new and higher standards of accuracy in high speed spindles. With Timken® tapered roller precision bearings and the new semi-flexible mounting, spindle accuracy is assured under varying conditions of speed, temperature and loading.

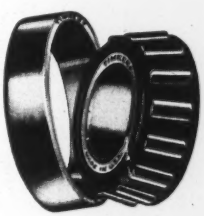
The new semi-flexible mounting was developed by engineers of The Timken Roller Bearing Company specifically to meet the requirements of higher spindle speeds. In this new mounting the rear spindle bearing is mounted in a carrier, one end of which has a slight clearance in the housing while the other end has a tight fit (see diagram above). The clearance between carrier and housing permits radial expansion to take place without excessive preloading of the bearings. The result is uniformly high spindle precision from beginning of the job to the end.

The new semi-flexible mounting has been thoroughly proved in tests and in machine tools now in operation. For full information, write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION